A Field Guide for Identification and Interpretation of Ecosystems of the Northwest Portion of the Prince George Forest Region

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS iii

1 INTRODUCTION 1

2 USE OF THE GUIDE 6
2.1 Identifying Biogeoclimatic Units 6
2.2 Identifying Site Units 7
2.2.1 Soils and topographic features 7
2.2.2 Vegetation features 7
2.2.3 Moisture and nutrient regimes 7
2.2.4 Identification of units 8
2.3 Management Interpretations 8

3 BIOGEOCLIMATIC UNITS 8
3.1 Sub-Boreal Spruce (SBS) Zone 9
3.1.1 Williston SBSmk - SBSmk2 (previously SBSo) 9
3.1.2 Finlay - Peace SBSwk - SBSwk2 (previously SBSj2) 11
3.1.3 Takla SBSwk - SBSwk3 (previously SBSn) 11
3.2 Engelmann Spruce - Subalpine Fir (ESSF) Zone 11
3.2.1 Omineca ESSFmv - ESSFmv3 (previously ESSFn3) 12
3.3 Boreal White and Black Spruce (BWBS) Zone 12
3.3.1 Stikine BWBSdk - BWBSdk1 (previously BWBSe) 12
3.4 Spruce - Willow - Birch (SWB) Zone 13
3.4.1 SWBb 13
3.5 Alpine Tundra (AT) Zone 16
3.5.1 Atn 16

4 THE SBSmk2 VARIANT 21

5 THE SBSwk2 VARIANT 36

6 THE SBSwk3 VARIANT 51

7 THE ESSFmv3 VARIANT 68

8 THE BWBSdk1 VARIANT 85

9 LITERATURE CITED 106

APPENDICES

1 Meso slope position diagram 108
2 Hand texturing field guide 109
3 Identification of upland humus forms 112
4 Key to the identification of potential moisture regime 113
5 Key to the identification of soil nutrient regime 115

TABLES

1 New names for biogeoclimatic and site units in the northwest portion of the Prince George Forest Region..... 3

2 Full correlated vegetation unit names for site series described in this guide..... 5

3 Summary climate data for biogeoclimatic units..... 10

FIGURES

1 Biogeoclimatic units of the northwest portion of the Prince George Forest Region..... 2

2 Edatopic grid displaying site series in the SBSwk2 variant..... 21

3 Edatopic grid displaying site series in the SBSwk2 variant..... 36

4 Edatopic grid displaying site series in the SBSwk3 variant..... 51

5 Edatopic grid displaying site series in the ESSFmv3 variant..... 68

6 Edatopic grid displaying site series in the BWBSdk1 variant..... 85

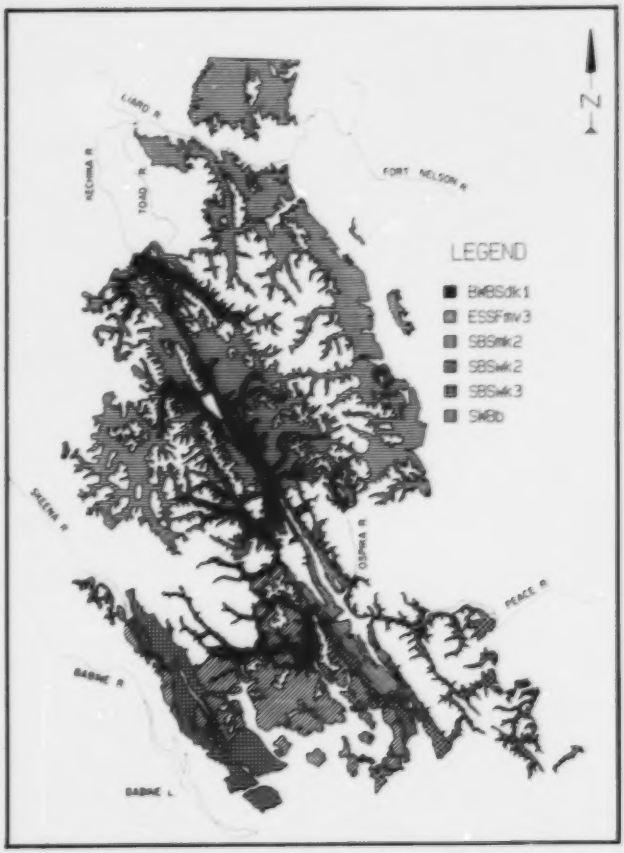

FIGURE 1. Biogeoclimatic units of the northwest portion of the Prince George Forest Region.

TABLE I. New names for biogeoclimatic and site units in the northwest portion of the Prince George Forest Region

Old variants and associations	New variants and site series
ATT SWB units[a]	(no change yet)
SBSjz	SBSwk2
01.1 Black Gooseberry - Oak Fern - Black Huckleberry	01 Sxw - Oak fern
01.2 Black Gooseberry - Oak Fern - Douglas Maple	01 Sxw - Oak fern
02 Black Huckleberry - Moss	02 Pl - Huckleberry - Cladina
03 Black Huckleberry - Bunchberry	03 Sxw - Huckleberry - Highbush-cranberry
No previous unit	04 Sb - Huckleberry - Clubmoss
04 Devil's Club - Oak Fern	05 Sxw - Devil's club
05 Spruce - Horsetail	06 Sxw - Horsetail
SBSh	SBSwk1
01 Black Huckleberry - Oak Fern	01 Sxw - Oak fern
02 Douglas-fir - Purple Peavine	02 Sxwfd - Purple peavine
03 Pine - False Solomon's Seal	03 Sxw - Huckleberry - Highbush-cranberry
05 Pine - Black Spruce	04 Sb - Labrador tea
04 Black Gooseberry - Black Twinberry	05 Sxw - Twinberry - Coltsfoot
06 Devil's Club - Fern	06 Sxw - Devil's club
07 Spruce - Horsetail	07 Sxw - Horsetail
SBSo	SBSwk2
01 Highbush-cranberry - Coltsfoot	01 Sxw - Huckleberry - Highbush-cranberry
02 Pine - Soopolallie	02 Pl - Feathermoss - Cladina
03 Pine - Sitka Alder	03 Sxw - Huckleberry - Soopolallie
04 Pine - Black Spruce	04 Sb - Huckleberry - Spirea
05 Devil's Club - Oak Fern	05 Sxw - Oak fern
06 Spruce - Horsetail	06 Sxw - Horsetail
BWBSe1[b]	BWBSdk1
01/04/05 Highbush-cranberry - Bunchberry or White Spruce - Step Moss	01 Sw - Knight's plume - Step moss
02 Pine - Lichen	02 Pl - Lingonberry - Feathermoss
03 Pine - Feathermoss	03 Sw - Wildrye - Toad-flax
04 Pine - Black Spruce	04 Sb - Lingonberry - Knight's plume
No previous unit	05 Sw - Soopolallie - Twinflower
No previous unit	06 Sw - Scouring-rush - Step moss
05/06/07 Black Spruce - Labrador Tea or Labrador Tea - Twinflower	07 Sb - Lingonberry - Coltsfoot
06/07 Spruce - Horsetail	08 Sw - Currant - Horsetail
07 Black Spruce - Sphagnum	09 Sb - Horsetail - Sphagnum

1 INTRODUCTION

This field guide describes the ecosystems of the northwest portion of the Prince George Forest Region (Figure 1). The area covered by the guide extends from Williston Reservoir and the Rocky Mountain Trench north of it, in the east, to the Prince George/Prince Rupert Forest Region boundary in the west, and from the base of Williston Reservoir in the south to the Regional boundary again in the north. To the north and west, the units described in this guide continue beyond the regional boundaries. The area falls within the Rocky Mountain Trench (north), and the Cassiar and Omineca mountains physiographic regions (Holland 1976). The guide presents aids to the identification of described units, and management interpretations for each.

The units in this guide are described in the biogeoclimatic ecosystem classification (BEC) system. It is assumed that the user has a working knowledge of this system. Those unfamiliar with the system should consult Pojar (1983) for a non-technical account, or contact the Ecology personnel in the Forest Sciences Section, B.C. Ministry of Forests, Prince George. Most of the units described in this guide have also been described in other publications and reports: MacKinnon (1987)[1] for the ESSFmv3 (previously ESSFn3); DeLong et al. (1985)[2] for the SBSwk2 (previously SBSj2); Trowbridge et al. (1983)[3], and Meidinger and Lewis (1983)[4] for the ATn, and Meidinger et al. (1986) for the SWBb. Wildlife values are described in Fenger et al. (1989).

The units described in this guide have been renamed as part of the provincial correlation of the ecological classification system. The old names, and the corresponding units described in this guide, are listed in Table 1. Additionally, the complete vegetation unit name for each site unit is given in Table 2. The SBSj1 and SBSj2 described in the central part of the

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[1] MacKinnon, A. 1987. Biogeoclimatic ecological classification of the Engelmann Spruce - Subalpine Fir (ESSF) Zone, ESSFn biogeoclimatic units. B.C. Min. For. and Lands, Prince George, B.C. Unpublished report. 50 p.

[2] DeLong, C., MacKinnon, A., and A. McLeod. 1985. A field guide for the identification and interpretation of ecosystems of the SBSj2 in the Prince George Forest Region. B.C. Min. For., Prince George, B.C. Unpublished report. 33 p.

[3] Trowbridge, R., J. Pojar, and T. Lewis. 1983. Interim classification of the Boreal White and Black Spruce Biogeoclimatic Zone in the Prince Rupert Forest Region. B.C. Min. For., Smithers, B.C. Unpublished report.

[4] Meidinger, D., T. Lewis and R. Kowall. 1986. Biogeoclimatic zones and subzones of the northern portion of the Mackenzie Timber Supply Area. North. Fire Ecology Project. B.C. Min. For., Victoria, B.C. Unpublished report. 59 p.

TABLE 1. (Continued)

Old subzones and associations	New variants and site series
ESSFm3	ESSFmv3
01 White-flowered Rhododendron - Black Huckleberry	01 Bl - Rhododendron - Feathermoss
02 Pine - Lichen	02 BlPl - Crowberry - Cladina
03 Black Huckleberry - Bunchberry	01 Bl - Rhododendron - Feathermoss
05 Pine - Black Spruce	03 BlSb - Labrador tea
04 Black Huckleberry - Oak Fern	04 Bl - Oak fern - Knight's plume
06 Devil's Club - Oak Fern	05 Bl - Devil's club - Rhododendron
07 Black Twinberry - Highbush-cranberry	06 Sxw - Huckleberry - Highbush-cranberry
No previous unit	07 Bl - Horsetail - Feathermoss

[a] SWB units have not yet been correlated.

[b] Various versions of descriptions for this subzone have preceded this guide so caution should be exercised in equating previous units to the new units.

TABLE 2. Full correlated vegetation unit names for site series described in this guide

Site series	Full vegetation unit name
SBSwk2	
01	Sx - Vaccinium - Viburnum; Mertensia
02	Pl - Pleurozium - Cladina; Orthilia
03	Sx - Vaccinium - Viburnum; Shepherdia
04	Sb - Vaccinium (membranaceum) - Petasites; Spiraea
05	Sx - Gymnocarpium; Arnica
06	Sx - Equisetum; Cornus
SBSwk2	
01	Sx - Gymnocarpium; Acer
02	Pl - Vaccinium (membranaceum) - Cladina
03	Sx - Vaccinium - Viburnum; Rubus (parviflorus)
04	Sb - Vaccinium (membranaceum) - Petasites; Lycopodium
05	Sx - Oplopanax; Rubus (parviflorus)
06	Sx - Equisetum; Cornus
SBSwk3	
01	Sx - Gymnocarpium; Arnica
02	Fd - Picea - Rubus; Lathyrus (nevadensis)
03	Sx - Vaccinium - Viburnum; Rubus (parviflorus)
04	Sb - Ledum
05	Sx - Lonicera - Petasites; Ribes
06	Sx - Oplopanax; Rubus (parviflorus)
07	Sx - Equisetum; Rubus
BWBSdk1	
01	Sw - Ptilium - Hylocomium; typicum
02	Pl - Vaccinium (vitis-idaea) - Pleurozium
03	Sw - Elymus - Geocaulon
04	Sb - Vaccinium (vitis-idaea) - Ptilium; Pleurozium
05	Sw - Shepherdia - Linnaea
06	Sw - Equisetum (scirpoides) - Hylocomium
07	Sw - Ptilium - Hylocomium; Galium (boreale)
08	Sb - Vaccinium (vitis-idaea) - Ptilium; Petasites
09	Sw - Ribes (triste) - Equisetum
10	Sb - Equisetum - Sphagnum
ESSFav3	
01	Bl - Rhododendron - Arnica; Sorbus
02	Pl - Empetrum - Cladina
03	Bl - Picea (mariana) - Ledum
04	Bl - Gymnocarpium - Ptilium; typic
05	Bl - Oplopanax - Rhododendron
06	Bl - Delphinium - Ptilium
07	Bl - Equisetum - Pleurozium

Prince George Region have been recognized as being very similar to the SBSn described in the western part of the Region. As a result, the SBSj1, SBSj2, and SBSn have been renamed the SBSwk1, SBSwk2, and SBSwk3, respectively. The SBSe2 and SBSo, also recognized as being very similar, have been renamed the SBSmk1 and the SBSmk2, respectively.

The new biogeoclimatic unit codes and names are designed to be connotative--that is, they describe the climate of the unit, relative to other subzones in the zone. The connotative symbols in this guide describe the relative moisture (x = very dry, d = dry, m = moist, w = wet, v = very wet) and relative temperature (v = very cold, c = cold, k = "kool", m = mild, w = warm, h = hot) for each subzone/variant within its zone. For example, the Wet, Cool ("Kool") Sub-Boreal Spruce biogeoclimatic unit is coded SBSwk; the Moist "Kool" unit is coded SBSmk.

The site units have also been correlated and renamed. The number of units has been reduced, and similar units in different variants have been given the same name. For instance, the units in this guide previously recognized as the "Black Huckleberry - Oak fern" (SBSn/01), "Black Gooseberry - Oak fern" (SBSj2/01), and "Devil's Club - Oak fern (SBSo/05) ecosystem associations are all now within "Sxw - Oak fern" site association. They share this name because they are site series which are recognized as having similar "quality" (actual available moisture and nutrients) and vegetation potential. They also respond in a similar fashion to management practices.

Until correlations of the SWB and the wetland units have been completed, these should be referred to by their old names. When correlation is complete, the appropriate pages in this guide will be replaced with the new descriptions of the correlated units.

2 USE OF THE GUIDE

The guide is divided into nine sections: the Introduction is Section 1; Section 2 describes the use of the guide; Section 3 describes the biogeoclimatic units (variants) included in the guide, and differentiates them; Sections 4-8 describe the site units within each variant, and their management interpretations; and Section 9 is Literature Cited.

2.1 Identifying Biogeoclimatic Units

Biogeoclimatic units are most easily identified from maps. Figure 1 provides an overview of the distribution of these units within the area covered by this guide. Biogeoclimatic unit maps at a scale of 1:250 000 are available from the Ministry of Forests (MOF) District Offices, or the Forest Sciences Section, MOF, Prince George.

If an area lies near a mapped biogeoclimatic unit boundary and it is not clear which biogeoclimatic unit it belongs to, the user should compare the site units found in the area to those described for both biogeoclimatic units, and select the unit that best fits.

2.2 Identifying Site Units

Site units can be identified by a combination of soil, site and vegetation factors, which together are used to derive ecological moisture and nutrient regimes for the site. Having selected the appropriate biogeoclimatic unit (Section 2.1), the user should inspect the area under consideration to determine if there are obvious moisture or nutrient differences which have led to the development of several vegetation units on the site. If several site units appear to be present, the user should stratify the area before identifying the units. At each different site unit, the user should then record site features (2.2.1) and vegetation features (2.2.2), and use these to determine moisture and nutrient regimes (2.2.3).

2.2.1 Soils and topographic features

The most important topographic characteristics to note are: slope position (Appendix 1), slope gradient, and aspect. The most important soil characteristics to note are: soil texture (procedures for determining soil texture are given in Appendix 2); coarse fragment %; humus form and depth (procedures for determining humus form are given in Appendix 3); soil drainage class; depth to water table; and rooting depth.

2.2.2 Vegetation features

The plant species on the site and their relative abundance should be noted. Vegetation as described in this guide is for climax or near-climax ecosystems. Caution must be exercised in using vegetation to classify disturbed sites. Species occurring infrequently but sometimes with moderate cover are enclosed in square parentheses ([ ]). Plant guides such as "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982) or "Some Common Plants of the Skeena Region" (Coupé et al. 1982) are helpful, and may be available from the Forest Sciences Section, MOF, Prince George.

2.2.3 Moisture and nutrient regimes

The information from soils, topography and vegetation is used to estimate the relative amounts of moisture and nutrients available for plant growth. The guide user must keep two important factors in mind:

i. Moisture and nutrient regimes are relative within a biogeoclimatic unit. For instance, a site that is average in moisture regime in the SBSwk2 will be wetter than a site that is average in moisture regime in the SBSmk2.

ii. All factors must be taken into account when soil moisture and nutrient regime are determined. One factor can compensate for another; for instance, a coarse-textured soil, which would be expected to be dry, could be wetter if it occurred at the base of a slope.

Moisture and nutrient regimes can be estimated using the keys in Appendices 4 and 5.

2.2.4 Identification of units

After gathering soils, topographic, and vegetation information, the user should now proceed to:

i. the edatopic grid (e.g., Figure 2) where the moisture and nutrient regime can be used to locate the site unit on the grid; and

ii. the key to site units, where dichotomous keys use the soils, topographic, and vegetation features to identify a site unit.

The edatopic grid and the key to site units will direct the user to a particular site unit, or units. Soils, topographic, and vegetation features on the site can then be compared with those summarized for the particular site unit(s) to ensure the proper site unit is identified. Soil and site features characteristic of a certain site unit, or particularly useful in distinguishing it from other site units, are marked with an asterisk (*).

2.3 Management Interpretations

Once the site unit has been identified, the management interpretations for that unit are available on the page adjacent to the site unit description. Interpretations are offered as guidelines to the preparation of management prescriptions; they detail the opportunities and constraints that a resource manager must consider when dealing with a particular ecosystem. Management interpretations will be revised as more information, different technologies and changing management objectives dictate. In the site preparation section of the interpretations, preferred methods of site preparation are marked with an asterisk (*). More information about mechanical site preparation is available in Coates and Haeussler (1987).

3 BIOGEOCLIMATIC UNITS

The northwest portion of the Prince George Forest Region (Figure 1) extends from Williston Reservoir and the Rocky Mountain Trench north of it, in the east, to the Prince George/Prince Rupert Forest Region boundary in the west, and from the base of Williston Reservoir in the south to the regional boundary again in the north. To the north and west, of course, the units described in this guide continue beyond the regional boundaries. The area covered by this guide falls within the Rocky Mountain Trench (north), and Cassiar and Omineca mountains physiographic subdivisions (Holland 1976).

Five biogeoclimatic zones are recognized in this area: the Sub-Boreal Spruce (SBS) zone at lower elevations in the south, with the Engelmann Spruce - Subalpine Fir (ESSF) zone above it in the subalpine; the Boreal White and Black Spruce (BWBS) zone at lower elevations in the north, with the Spruce - Willow - Birch (SWB) and ESSF above it in the subalpine; and the Alpine Tundra (AT) zone above treeline over the entire area.

No units have been described in the SWB or AT, and consequently these zones are not discussed beyond this section.

3.1 Sub-Boreal Spruce (SBS) Zone

The SBS zone within the study area occurs: around the flat shores of Williston Reservoir as far north as Ingenika Arm (SBSmk2 - previously SBSo); in the valley between the Rocky and Omineca Mountains, as far north as Peace Reach, surrounding the SBSmk2 and fingering into the side valleys of both ranges (SBSwk2 - previously SBSj2); and in the valleys of the western Omineca and eastern Skeena Mountains (SBSwk3 - previously SBSn). Above all three SBS variants lies the ESSF; the SBS occurs below about 1100 m over most of the area.

The climate is fairly uniform in the SBS throughout this area, with the SBSwk2 and (presumably) SBSwk3 being wetter than the SBSmk2. Climate data are summarized in Table 3.

The SBS has climax forests dominated by hybrid white spruce (Picea glauca x P. engelmannii), subalpine fir (Abies lasiocarpa), or occasionally Douglas-fir (Pseudotsuga menziesii) (in the very south of the SBSwk3) or lodgepole pine (Pinus contorta) (on very dry sites, or on some ecosystems with black spruce). The ESSF forests have canopies dominated by Engelmann spruce (Picea engelmannii) and subalpine fir, with white-flowered rhododendron (Rhododendron albiflorum) in the understory. Forests of the BWBS to the north have more black spruce (Picea mariana) and lodgepole pine in the main canopy on upland sites, primarily white spruce (Picea glauca) rather than hybrid white spruce, and the presence (e.g., mountain monkshood [Aconitum delphiniifolium]) and absence (e.g., most ferns) of key indicator species.

3.1.1 Williston SBSmk - SBSmk2 (previously SBSo)

The SBSmk2 occurs around the flat shores of Williston Reservoir, from Mackenzie in the south to Ingenika Arm in the north, and north up the Ospika Arm (see Figure 1). This is the driest of the SBS units described in the area, being in the rainshadow of the Omineca Mountains. Climate data are presented in Table 3.

Climax forests have canopies of hybrid white spruce, with lodgepole pine on drier sites and subalpine fir on wetter sites. Lodgepole pine is a common seral species on most sites. The SBSmk2 is most easily distinguished from the SBSwk2 by the absence of oak fern (Gymnocarpium dryopteris) on mesic sites.

TABLE 3. Summary climate data for biogeoclimatic units[a]

BGC unit	Seasonal precipitation May-Sept (mm)		Annual precipitation (mm)		Annual mean temperature (°C)		Mean annual snowfall (cm)		Frost-free period (days)	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
SBSmk2	250	210-295	690	N/A	+1.2	+0.7-+1.9	335	N/A	75	N/A
SBSwk2	335	210-535	905	550-1915	+1.0	-0.1-+1.7	1075	N/A	80	N/A
SBSwk3	260	225-295	610	520- 700	N/A	N/A	N/A	N/A	N/A	N/A
ESSFmv3	260	205-315	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BWBSdk1	225	130-280	405	325-505	-0.2	-1.9-+2.0	180	135-270	65	45-110
SWBb	350	255-445	580	460-700	-1.9	-0.5--3.2	270	145-395	35	N/A
ATn	425	285-560	1460	755-2170	-0.8	-1.8-+0.2	1265	550-1975	50	20-65

[a] Reynolds, G. 1989. Climatic data summaries for the biogeoclimatic zones of British Columbia. B.C. Ministry of Forests, Research Branch. Unpublished report.

The extensive lowland habitat that surrounds Williston Reservoir supports small populations of wintering moose and caribou, black bear and grizzly bear, as well as many species of furbearers, such as marten, lynx, wolverine, gray wolf, beaver and muskrat. Most of the important wintering habitat for moose and caribou has been flooded by the reservoir.

3.1.2 Finlay - Peace SBSwk - SBSwk2 (previously SBSj2)

The SBSwk2 occurs at lower elevations (below 1100 m) in the valley between the Rocky and Omineca mountains, surrounding the SBSmk2 and fingering into the side valleys of both mountain ranges (see Figure 1). Correlation has lumped this unit with the SBSwk3 (formerly SBSn) as variants. This was done to reflect the similarity of zonal (average moisture and nutrient regime) sites. (The SBSwk1 [formerly SBSj1] is the third variant in this subzone.)

Climate in the SBSwk2 is wet and cool, with mean annual precipitation of 824 mm and mean annual temperature of +0.7°C. The wetter climate of this and the SBSwk3 reflects their position in the foothills and valley bottoms of major mountain ranges.

Climax forests have canopies of hybrid white spruce and subalpine fir, with lodgepole pine as a seral species on mesic and drier sites, and as a topoedaphic climax species on very dry sites. Devil's club (Oplopanax horridus) is more common in this subzone than the SBSmk2.

This variant provides summer habitat for moose, mule deer, black bear and grizzly bear, and early fall habitat for caribou.

3.1.3 Takla SBSwk - SBSwk3 (previously SBSn)

The SBSwk3 occurs in the valleys of the western Omineca Mountains, at elevations below 1100 m, from Trembleur and Inzana lakes in the south, north to the north end of Bear Lake (see Figure 1) and probably further north and west.

Climate in the SBSwk3 has not been well documented, but is assumed (from vegetation development) to be very similar to that of the SBSwk2.

Climax forests in the SBSwk3 are similar to those in the SBSwk2, with canopies dominated by hybrid white spruce and subalpine fir, and lodgepole pine as a common seral and topoedaphic species. Some ecosystems in the southern portions of this variant have Douglas-fir in the canopy.

This variant provides summer habitat for moose, black bear and grizzly bear, as well as habitat for beaver, muskrat, spruce grouse and ruffed grouse.

3.2 Engelmann Spruce - Subalpine Fir (ESSF) Zone

The ESSF zone within the study area consists of one variant, the ESSFmv3 (previously ESSFn3).

3.2.1 Omineca ESSFmv - ESSFmv3 (previously ESSFn3)

The ESSFmv3 within the study area occurs above approximately 1100 m and below the Alpine Tundra. It is replaced in the northern latitudes by another subalpine zone, the SWB (see Figure 1).

The climate of the ESSFn3 is moist and very cold, with 714 mm of total annual precipitation, the majority falling as snow. Mean annual temperature is -0.2°C. The ESSF units in general are cooler and wetter than the SBS units which occur below them.

Climax forests have canopies of Engelmann spruce and subalpine fir.

This variant provides a variety of habitats for wildlife. Mature stands of pine and spruce with dense arboreal lichen are used by caribou in the winter. Moist sites such as avalanche tracks and subalpine meadows are used in the summer by moose, black bear and grizzly bear. The extensive conifer forests are used by marten, red squirrel, spruce grouse, great horned owl and great gray owl. South-facing rock outcrops are used by mountain goat during the winter.

3.3 Boreal White and Black Spruce (BWBS) Zone

The BWBS zone within the study area consists of one subzone, the BWBSdk1 (previously BWBSe).

3.3.1 Stikine BWBSdk - BWBSdk1 (previously BWBSe)

The Cordilleran Boreal White and Black Spruce (BWBSdk1) subzone is a lowland to montane subzone occurring north of Germansen Landing between 250 and 1100 m in elevation, in the main valleys of the Omineca Mountains (see Figure 1).

Climate is cooler and drier than that of the SBS in the study area, though growing season temperatures may exceed those in any other biogeoclimatic unit covered in this guide. Climate data (based on limited sampling) are summarized in Table 3.

Forestry activities have been limited in the BWBSdk1, though the area can be expected to be extensively harvested as licensees move north. Climax forests have canopies of white spruce (Picea glauca) and lodgepole pine, with black spruce sometimes occurring in the main canopy on upland sites. The entire subzone is climatically dry, and has an extensive fire history, documented in Parminter (1984)[5]. Lodgepole pine is a common topoedaphic and climatic climax species. It also forms extensive seral stands. Moist and wet indicator species such as devil's club (Oplopanax horridus) and the larger ferns (e.g., spiny wood fern [Dryopteris assimilis] and lady fern [Athyrium filix-femina]), common in the SBS, are absent here.

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[5] Parminter, J. 1984. Fire-ecological relationships for the biogeoclimatic zones of the northern portion of the Mackenzie Timber Supply Area. North. Fire Ecology Project. B.C. Min. For., Victoria, B.C. Unpublished report. 102 p.

This subzone provides some of the best remaining moose winter habitat in the Finlay watershed. A relict population of Rocky Mountain elk occurs in the Ingenika Valley. The riparian habitats and lowlands support moose, black bear, grizzly bear, gray wolf, beaver, muskrat and spruce grouse. Mature stands of pine and spruce with dense arboreal and sometimes terrestrial lichen are used by caribou during the winter. The extensive conifer forests are used by marten, red squirrel, spruce grouse, great horned owl and great gray owl.

3.4 Spruce - Willow - Birch (SBS) Zone

The SWB zone within the study area consists of one subzone, the SWBb.

3.4.1 SWBb

The SWBb was sampled and described as part of the Northern Fire Ecology Project. The material presented here is from Meidinger et al. (1986)[6], and Pojar (1983). As the site units have not been formally described, they are dicussed here in general terms only and not dealt with elsewhere in the report.

The SWBb is the subalpine subzone occurring north of the Mesilinka River, and northeast of the Skeena River, to the Yukon and Northwest Territories borders. It ranges in elevation from 1050 to 1500 m, dropping as low as 800 m in some cold valleys. The SWBb occurs above the BWBSdk1 to the west of the Rocky Mountain Trench. Over much of the northern area covered by this guide, however, where the elevation does not drop below 1050 m, the SWBb occurs down to the valley bottoms (see Figure 1).

Climate is interior subalpine, cold throughout the year and cool even in the summer. Total annual precipitation is low (569 mm), with the vast majority falling as snow. Climate data for the SWBb are summarized in Table 3.

The zonal ecosystem of the SWBb is a White Spruce - Grey-leaved Willow - Scrub Birch association. The relatively open tree canopy is usually dominated by white spruce, with a minor component of subalpine fir, although the latter species may co-dominate with white spruce in some stands. Of the seral species in this association, lodgepole pine is often present and trembling aspen occasionally. The shrub layer is usually moderately to well developed and is dominated by scrub birch (Betula glandulosa), willows, shrubby cinquefoil (Potentilla fruticosa), and soopolallie (Shepherdia canadensis). The moderately to poorly developed herb layer is dominated by the dwarf woody plants crowberry (Empetrum nigrum) and lingonberry (Vaccinium vitis-idaea). The well-developed

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6 Meidinger, D., T. Lewis and R. Kowall. 1986. Biogeoclimatic zones and subzones of the northern portion of the Mackenzie Timber Supply Area, British Columbia. North. Fire Ecology Project. B.C. Min. For., Victoria, B.C. Unpublished report. 59 p.

moss layer is dominated by step moss, although red-stemmed feathermoss is often common. Cladina lichens and the leafy lichens Peltigera aphthosa and Nephroma arcticum are usually present.

On dry (subxeric), coarse-textured glaciofluvial materials or on south-facing slopes of coarse morainal deposits, a Lodgepole Pine - Scrub Birch - Lichen association is found. The relatively open canopy of these woodland ecosystems is dominated by lodgepole pine, with a minor component of white spruce. Trembling aspen and subalpine fir occasionally occur as well. The moderately to poorly developed shrub layer is usually dominated by scrub birch; but sometimes white spruce, lodgepole pine, or subalpine fir dominate the understory. The herb layer is dominated by dwarf woody plants such as crowberry, kinnikinnick (Arctostaphylos uva-ursi), lingonberry, and dwarf blueberry (Vaccinium caespitosum). The moss layer is only moderately developed and is co-dominated by mosses and lichens; litter cover is significant.

On gravelly fluvial materials (fans and upper terraces) a slightly moister association (a White Spruce - [Lodgepole Pine] - Step Moss association) is found. The tree layer is well developed and is dominated by white spruce, often with a significant component of lodgepole pine. Trembling aspen and black spruce are infrequent species. The shrub layer is poorly developed, likely as a result of the denser canopy. Common species are grey-leaved willow, soopolallie, and common juniper. The herb layer is moderately developed, with fuzzy-spiked wildrye (Elymus innovatus), Altai fescue (Festuca altaica), arctic lupine (Lupinus arcticus), one-sided wintergreen (Orthilia secunda), bastard toadflax (Geocaulon lividum), and twinflower (Linnaea borealis) being the common species. The well-developed moss layer is dominated by step moss.

On dry, high-elevation, steep south aspects, stunted groves of trembling aspen or balsam poplar are often found. The two types often occur adjacent to each other but there are seldom mixed stands. The trembling aspen stands occur on colluvial slopes, which are subxeric to submesic in moisture regime, while the balsam poplar stands are usually on the moister sites. Both the trembling aspen and balsam poplar stands comprise stunted and gnarled trees often at least 50-80 years old. The shrub and herb layers are diverse and well developed. Common understory species are soopolallie, prickly rose (Rosa acicularis), highbush-cranberry (Viburnum edule), willows (Scouler's, grey-leaved, and Barclay's), fireweed, arctic lupine, tall bluebells (Mertensia paniculata), heart-leaved arnica (Arnica cordifolia), wild strawberry (Fragaria virginiana), and tall larkspur (Delphinium glaucum). Kinnikinnick and twinflower are more common in the trembling aspen stands, and species such as fuzzy-spiked wildrye and mountain monkshood (Aconitum delphiniifolium) are more common in the balsam poplar stands. The moss layers are very poorly developed in both these ecosystems. Although these stands are likely successional to some white spruce ecosystem, no conifer regeneration was noted in the stands examined. Because of repeated fires, they are considered to be fire sub-climax ecosystems.

On fine-textured morainal materials with subhygric to hygric moisture regimes, open white spruce - subalpine fir stands with well-developed herb layers are found. The shrub layer is dominated by grey-leaved willow, with scrub birch also common. Common herbs include Altai fescue, Arctic lupine, tall bluebells, heart-leaved arnica, tall larkspur, mountain monkshood, and subalpine daisy (Erigeron peregrinus). The well-developed moss layer is dominated by step moss and red-stemmed feathermoss. Common leafy liverwort (Barbilophozia lycopodioides) is also present.

Forested transitional bogs are quite variable, but commonly include more open canopies of black spruce, white spruce, and sometimes subalpine fir. Scrub birch is the most common shrub in the well-developed shrub layer. Grey-leaved willow, Barclay's willow, and Labrador tea (Ledum groenlandicum) are also common. Common herbs are lingonberry, cloudberry (Rubus chamaemorus), crowberry, and wood horsetail (Equisetum sylvaticum). The mosses vary in abundance, but include sphagnum mosses, glow moss (Aulacomnium palustre), red-stemmed feathermoss, and common haircap moss (Polytrichum commune).

On very steep north aspects, open stands of white spruce on permafrost soils can occur. Black spruce can also be present at lower elevations. These stands have moderately to well-developed shrub and herb layers, dominated by Labrador tea, scrub birch, willows, arctic lupine, tall Jacob's-ladder (Polemonium caeruleum), polargrass (Arctagrostis latifolia), dwarf scouring rush (Equisetum scirpoides), red bearberry (Arctostaphylos rubra), tall larkspur, cloudberry and lingonberry. The well-developed moss layer is dominated by step moss and glow moss. The soils are Organic Cryosols, with permafrost at a depth of 50-75 cm.

Shrub-dominated ecosystems are common, ranging from swamps and fens to dry colluvial scrub. Shrubby ecosystems are especially common in the wide valleys influenced by cold air drainage, on dry colluvial slopes, and in the upper elevation parkland-scrub.

Subalpine grasslands are frequent, but not extensive in the SWB (Pojar 1983).

Forestry capability of the SWB is limited by the northerly latitude and subalpine continental climate. The SWB is near the limit of climatic conditions that can support forest growth. Most of the zone likely produces less than 1 m^3/ha per year, although sites with warmer soil temperatures and a longer growing season (i.e., favourable S and W aspects, coarser-textured glaciofluvial fans and terraces, lower elevations) might produce up to 2-2.5 m^3/ha per year. The SWB in the Mackenzie TSA is the southernmost part of the zone and sites are generally more productive than the zone as a whole. Existing mature stands, however, are short and often quite open, and are therefore mostly non-commercial now and into the foreseeable future. If managed, rotation lengths in the order of 150 years could be expected.

The management of lands in the SWB and of the fires that these lands inevitably experience needs to be based on appreciation of the realities of resource capabilities. The capability of the SWB for wildlife is not easily surpassed (Pojar et al. 1983).[7] This subzone provides a variety of habitats for wildlife in northern British Columbia. Valley bottom riparian forests and wetlands are used by moose, grizzly bear, black bear and gray wolf. Open pine forests with terrestrial or arboreal lichen are used by caribou in the winter. The extensive shrub-filled valleys are used by moose, caribou, grizzly bear, gray wolf, wolverine and willow ptarmigan. Avalanche tracks and seepage sites are important for grizzly bear. Steep southerly aspect grass/shrub habitats are used by Stone's sheep, especially in the winter, while the more rugged, higher elevation sites are used by mountain goat. In the Rocky Mountain Foothills, the southerly-facing aspen/shrub/grass habitats are important for Rocky Mountain elk, moose, gray wolf and grizzly bear. As well, small populations of both mule deer and white-tailed deer use this habitat in the Muskwa Valley, and a large herd of Plains Bison has escaped captivity and taken up residence in this subzone within the Sikanni Chief and Halfway river watersheds of the Rocky Mountain Foothills.

The potential for recreation, particularly of the wilderness type, is also excellent. In accordance with society's desire for wildlife for consumptive and non-consumptive use, localized key habitats could be managed or enhanced by prescribed fire.

3.5 Alpine Tundra (AT) Zone

The AT zone within the study area consists of one subzone, the ATn.

3.5.1 ATn

The ATn was described in Meidinger and Lewis (1983)[8], primarily from the work of Pojar (1986) and Luckhurst (1973). As the site units have not been formally described, and as the area has no value in forestry terms, the site units are described in general terms here and not dealt with elsewhere in the report.

The climate of the ATn is the most severe of any biogeoclimatic unit in British Columbia. Winters are long and cold, with at least 7 months with mean temperature less than 0°C. Frost-free periods are very short, and frost can occur at any time during the year.

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[7] Pojar, J., R. Trowbridge, and T. Lewis. 1983. Biogeoclimatic zones of the Cassiar Timber Supply Area, northwestern British Columbia. B.C. Min. For., Smithers, B.C. Unpublished report.

[8] Meidinger, D. and T. Lewis. 1983. Biogeoclimatic zones and subzones of the Fort Nelson Timber Supply Area, British Columbia. Northern Fire Ecology Project. B.C. Min. For., Victoria B.C. Unpublished report. 59pp.

The ATn is the alpine subzone throughout the area covered by this guide, occurring at elevations above approximately 1500 m, over the ESSFmv3 and the SWBb subalpine units. The ESSFmv3 and SWBb grade into parkland (or scrub) subzones in their upper elevations below treeline.

The AT is characteristically a treeless zone. Trees, however, do occur sporadically in the alpine, but usually in a krummholz form. Alpine vegetation is dominated by shrubs, herbs, bryophytes, and lichens. Rocks, ice, and snow are also characteristic of much of the alpine landscape.

Alpine plant communities vary from shrubfields or scrub-dominated vegetation at lower elevations, to grass- and/or herb-dominated vegetation at middle elevations, to lichen-dominated vegetation at the highest elevations.

Alpine plants are usually small, close to the ground, and often separated by bare soil or rock. The environment is harsh in the alpine and the tundra vegetation does little to modify the micro-environment. Therefore, the effect of environmental factors such as topographic position, exposure to wind and insolation, and distribution of snow and meltwater, are strongly expressed in alpine plant communities. Hence, alpine vegetation is often present as a complex mosaic in response to environmental and soil conditions.

"Tundra" vegetation, consisting of prostrate shrubs, short-stemmed perennial herbs, bryophytes, and lichens, dominates the ATn. Some shrub thicket or scrub vegetation is found at the lower elevations.

The zonal ecosystem of the ATn is a "dwarf willow - sedge - grass - cryptogam" tundra. The dominant and characteristic species are netted willow (Salix reticulata), polar willow (Salix polaris), small-awned sedge (Carex microchaeta), awned haircap moss (Polytrichum piliferum), and the lichens Cetraria spp., Stereocaulon spp., and Thamnolia vermicularis. Other common species are alpine sweetgrass (Hierochloe alpina), Altai fescue, alpine bluegrass (Poa alpina), alpine fescue (Festuca brachyphylla), alpine bistort (Bistorta vivipara), and moss campion (Silene acaulis). The zonal ecosystem occurs over a wide range of mesic to moist (subhygric) sites on moderately sloping to flat topography. Soils include Sombric and Melanic Brunisols, Regosols, and Cryosols.

On exposed, windswept, convex ridges, a "cushion plant" tundra is found. Soils are usually Brunisols or Regosols on gravelly or rubbly colluvial veneers. Bare mineral soil is often exposed and frost sorting and heaving are active processes producing patterned ground. Common plants include entire-leaved white mountain-avens (Dryas integrifolia), blackish locoweed (Oxytropis nigrescens), moss campion, one-flowered cinquefoil (Potentilla uniflora), netted willow, alpine sweetgrass, small-awned sedge, and Bellard's kobresia (Kobresia myosuroides).

Another widespread ecosystem is the "alpine heath", characterized by four-angled mountain-heather (Cassiope tetragona), entire-leaved white mountain-avens, and netted and polar willows. Although it is possibly zonal at low elevations of the ATn, it is best developed on moist to mesic northern and eastern slopes. This is likely due to the greater snow accumulation and duration on these aspects. Soils are variable, and may be Dystric Brunisols, Regosols, Gleysols, Cryosols, or Organics. Seepage and solifluction are common processes. Although the dwarf shrubs are dominant, common herbs include moss campion, capitate lousewort (Pedicularis capitata), alpine bistort, small-awned sedge, short-stalked sedge (Carex podocarpa), arctic bluegrass (Poa arctica), and Altai fescue.

Fairly common on steep, generally south-facing slopes is an "Altai fescue - lichen tundra" ecosystem. Sites are well drained, mesic to slightly drier, and with light, discontinuous winter snow cover. Soils are usually Sombric or Melanic Brunisols. Vegetation is dominated by Altai fescue and mountain sage. Other common herbs are alpine sweetgrass, small-awned sedge, and spiked woodrush (Luzula spicata). Common cryptogams include awned haircap moss and the lichens Cetraria spp., Cladina spp., Cladonia spp., and Stereocaulon spp.

Alpine seepage and snowbed areas are common, although often small. The vegetation is heterogeneous, so only the most widespread middle- to high-elevation seepage/snowbed type will be described here. The vegetation of this type is dominated by netted and polar willows, short-stalked sedge, arctic colt's-foot (Petasites frigidus), mountain sage, subalpine buttercup (Ranunculus eschscholtzii), and northern anemone (Anemone parviflora). A great diversity of other herbs is found, including white marsh-marigold (Caltha leptosepala), red willowherb, dwarf scouring rush, alpine bistort, red-stemmed saxifrage (Saxifraga lyallii), alpine speedwell (Veronica wormskioldii), Lapland reedgrass (Calamagrostis lapponica), three-flowered rush (Juncus triglumis), chestnut rush (Luzula parviflora), and alpine bluegrass. The soils are Gleysolic, Cryosolic, or Organic.

Alpine fellfield occurs on many mountain tops and high ridge crests. Terms such as "mountain-top detritus", "rubble sheet", and "blockfield" are used to describe this landscape unit. Fellfields are extensive areas of coarse, angular debris that form on level or gently sloping areas as a result of frost shattering and heaving. The windswept, complex terrain is a mosaic of snow-free patches and accumulation areas, and this factor influences the distribution of plants within the fellfield. Although a number of plant communities could be described on a microscale, overall the fellfields can be treated as a single unit. Vascular plants and most mosses and fruticose lichens are restricted to protected depressions and crevices. The most common herbs are alpine bitter-cress (Cardamine bellidifolia), alpine rockcress (Draba alpina), moss campion, tufted saxifrage (Saxifriga caespitosa), three-toothed saxifrage, purple

mountain saxifrage (Saxifrage oppositifolia), arctic cinquefoil (Potentilla hyparctica), short-awned sedge, alpine fescue, and curved alpine woodrush (Luzula arcuata). Dominant cryptogams are the mosses Rhacomitrium lanuginosum and awned haircap moss, and the lichens Cetraria spp., Dactylina spp., Parmelia spp., Umbilicaria spp., Stereocaulon spp., and Thamnolia vermicularis. The soils of these periglacially active areas are Regosols.

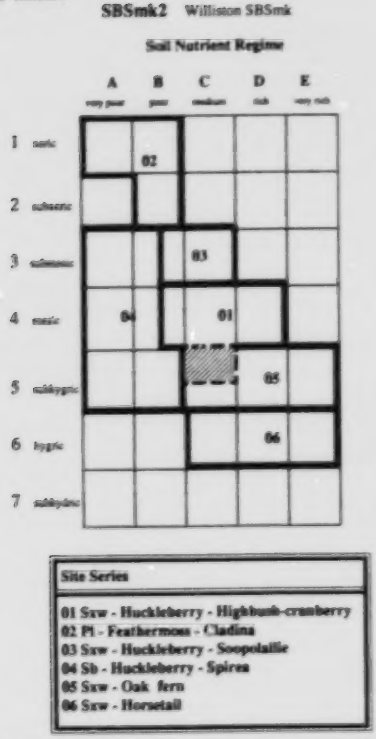
Alpine shrub-dominated ecosystems are common at low to middle elevations. They are of two basic types: scrub birch thickets and Barratt's willow thickets. The scrub birch communities are common on mesic to moist, upper colluvial slopes and on glaciofluvial materials in high, exposed passes. The Barratt's willow communities are found on wet sites in alpine valleys, usually on gently sloping alluvial fans at the base of long slopes and within the meander plain of low-gradient alpine streams.

There is no wood production potential in the Alpine Tundra Zone. However, in conjunction with the subalpine SWB Zone, it provides some of the most important wildlife habitat in British Columbia. Moist, herbaceous meadows are used by Stone's sheep, caribou, willow ptarmigan, hoary marmot, and grizzly bear. Rounded, windswept vegetated ridges are used as winter habitat by caribou and Stone's sheep. Steep, rugged vegetated alpine is used by mountain goat. Most of the higher elevation alpine in the Muskwa and Cassiar ranges is barren, devoid of herbaceous vegetation and therefore not supporting wildlife, except it is often used by cow caribou during calving, or by cliff-nesting birds of prey such as gyrfalcon and golden eagle.

The potential for recreation is high. The alpine terrain varies from the rugged Battle of Britain Range to the more rounded Omineca Mountains. Most areas provide a wide diversity of alpine vegetation. In combination with the SWB, most of the area has considerable vegetation and wildlife diversity, and provides many opportunities for hiking, horseback riding, and hunting. A few guide-outfitters operate in the area. Despite the great potential, the remoteness of this area continues to limit the recreational use of the alpine.

NOTES

4 THE SBSmk2 VARIANT



Site Series
01 Sxw - Huckleberry - Highbush-cranberry
02 Pl - Feathermoss - Cladina
03 Sxw - Huckleberry - Soopolallie
04 Sb - Huckleberry - Spirea
05 Sxw - Oak fern
06 Sxw - Horsetail

FIGURE 2. Edatopic grid displaying site series in the SBSmk2 variant.

KEY TO SITE UNITS OF THE SBSmk2

1a Organic soils

Bog ecosystems

1b Mineral soils

2a Canopy dominated by white spruce

3a Usually level; often adjacent to moving water; Equisetum spp. (p. 24)[9] moderate to high cover (>5% cover)

SBSmk2/06

3b Slope position variable; often not adjacent to moving water; Equisetum spp. low cover (<1%) or absent

4a Generally lower slope, or level and influenced by water table; Oplopanax horridus (p. 10) and Gymnocarpium dryopteris (p. 26) moderate to high cover (>1%)

SBSmk2/05

4b Generally not lower slope and if level, not influenced by a water table; Oplopanax horridus and Gymnocarpium dryopteris low cover (<5%) or absent

5a Generally upper slope or crest, if level then coarse textured; Lonicera involucrata (p. 9) low cover (<1%) or absent

SBSmk2/03

5b Generally mid to toe slope, if level then medium textured; Lonicera involucrata generally moderate cover (>5%)

SBSmk2/01

2b Canopy dominated by lodgepole pine

6a Generally lower slope, or level and influenced by water table; Oplopanax horridus (p. 10) and Gymnocarpium dryopteris (p. 26) moderate to high cover (>1%)

SBSmk2/05

6b Generally not lower slope and if level, not influenced by a water table; Oplopanax horridus and Gymnocarpium dryopteris low cover (<1%) or absent

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[9] Page numbers refer to the publication "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982).

7a Slope gradient 10%, aspect flat or north-facing; black spruce present in canopy

SBSmk2/04

7b Slope gradient and aspect variable; black spruce absent from canopy

8a Level or crest slope position; coarse-textured soils; Arctostaphylos uva-ursi (p. 16) present

SBSmk2/02

8b Slope position and soil texture variable; Arctostaphylos uva-ursi absent

9a Generally upper slope or crest, if level then coarse-textured; Lonicera involucrata low cover (<1%) or absent

SBSmk2/03

9b Generally mid to toe slope, if level then medium textured; Lonicera involucrata generally moderate cover (>5%)

SBSmk2/01

SBSmk2/01

Sxw - HUCKLEBERRY - HIGHBUSH-CRANBERRY

VEGETATION

Viburnum edule

Vaccinium membranaceum

Petasites palmatus

Tree Layer: 40% cover
Hybrid white spruce, lodgepole pine

Shrub Layer: 50% cover

Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
Lonicera involucrata	(black twinberry)
Vaccinium membranaceum	(black huckleberry)
Alnus viridis ssp. sinuata	(Sitka alder)
[Rubus parviflorus	(thimbleberry)]
subalpine fir	
hybrid white spruce	

Herb Layer: 70% cover

Cornus canadensis	(bunchberry)
Petasites palmatus	(palmate coltsfoot)
Linnaea borealis	(twinflower)
Rubus pubescens	(trailing raspberry)
Smilacina racemosa	(false Solomon's seal)
Mitella nuda	(common mitrewort)
Orthilia secunda	(one-sided wintergreen)
Lycopodium annotinum	(stiff clubmoss)
Epilobium angustifolium	(fireweed)
Aralia nudicaulis	(wild sarsaparilla)
Mertensia paniculata	(tall bluebells)
Equisetum arvense	(common horsetail)
Pyrola asarifolia	(rosy wintergreen)
Geocaulon lividum	(bastard toad-flax)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

	Moisture Regime:	mesic
	Nutrient Regime:	poor - rich
*	Slope Gradient (%):	0-25
*	Slope Position:	mid to toe or level
	Parent Material:	morainal or (glacio)fluvial
*	Soil Texture:	usually moderately coarse or medium
	Coarse Fragments(%):	0-75
	Site Index:	Pl 28 (26-30) Sx 29 (24-34)

DISTRIBUTION: very common

SXW - HUCKLEBERRY - HIGHBUSH-CRANBERRY (SBSmk2/01)

INTERPRETATIONS

Logging:
- clearcut
- attempt to reduce slash accumulations
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals

Site preparation:

Objective
- enhance natural regeneration; reduce debris; improve planter access

Mechanical
- light drag scarify*; patch scarify; mix humus with mineral soil

Prescribed fire
- light broadcast burn (remove L horizon) if logged in winter; pile and burn (if stand has 60%+ component of Sx)

Species choice:

Preferred
Acceptable
- Pl, Sx

Brush hazard:
- moderate to high (trembling aspen, fireweed, black twinberry, thimbleberry)
- post-planting inspections of harvested sites should be carried out to determine the need for vegetation control

Reforestation:
- do not accept advance Bl regeneration
- conduct a Pl cone survey. If cones are insufficient and competition moderate, plant Pl stock without site preparation.
- plant Sx if Sx was leading species in original stand, or if there is a high component of aspen on site

Concerns:
- mistletoe, gall rust (if managing for Pl); consider sanitation thinning on Pl stands infected with mistletoe or gall rust
- frost heaving on coarse-textured soils

SBSmk2/02

P1 - FEATHERMOSS - CLADINA

Shepherdia canadensis

A. uva-ursi

Cladina spp.

VEGETATION

Tree Layer: 10% cover
Lodgepole pine

Shrub Layer: 30% cover

Shepherdia canadensis	(soopolallie)
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
Spiraea betulifolia	(birch-leaved spirea)
lodgepole pine	
subalpine fir	

Herb Layer: 10% cover

Arctostaphylos uva-ursi	(kinnikinnick)
Linnaea borealis	(twinflower)
Oryzopsis asperifolia	(rough-leaved ricegrass)
Epilobium angustifolium	(fireweed)
Cornus canadensis	(bunchberry)
Vaccinium caespitosum	(dwarf blueberry)
Orthilia secunda	(one-sided wintergreen)

Moss Layer: 85% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Polytrichum juniperinum	(juniper haircap moss)
Cladina spp.	

SOIL AND SITE

Moisture Regime:	xeric - subxeric
Nutrient Regime:	very poor - poor
Slope Gradient (%):	0-60
• Slope Position:	level or crest
Parent Material:	(glacio)fluvial or morainal
• Soil Texture:	usually coarse
Coarse Fragments (%):	0-55
Site Index:	P1 23 (15-32)

DISTRIBUTION: common, especially in large valley bottoms, but small in area

Pl - FEATHERMOSS - CLADINA (SBSmk2/02)

INTERPRETATIONS

Logging:
- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals

Site preparation:

Objective
- enhance natural regeneration; improve moisture status; reduce debris; improve planter access

Mechanical
- light drag scarify*; disc trench; mix humus with mineral soil

Prescribed fire
- do not burn

Species choice:

Preferred
Acceptable
- Pl

Brush hazard:
- low

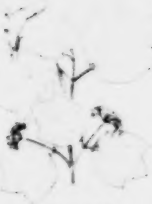
Reforestation:
- conduct a Pl cone survey. If enough seed is present, mechanically treat site. If cones are insufficient, plant Pl stock without site preparation.

Concerns:
- extreme drought periods
- mistletoe and gall rust

SBSmk2/03

Sxw - HUCKLEBERRY - SOOPOLALLIE

VEGETATION



Viburnum edule

Tree Layer: 30% cover
Lodgepole pine, hybrid white spruce

Shrub Layer: 45% cover

Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
Shepherdia canadensis	(soopolallie)
Alnus viridis ssp. sinuata	(Sitka alder)
Spiraea betulifolia	(birch-leaved spirea)
Vaccinium membranaceum	(black huckleberry)
subalpine fir	
hybrid white spruce	

Rosa acicularis

Herb Layer: 35% cover

Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Smilacina racemosa	(false Solomon's-seal)
Orthilia secunda	(one-sided wintergreen)
Epilobium angustifolium	(fireweed)
Rubus pubescens	(trailing raspberry)
Oryzopsis asperifolia	(rough-leaved ricegrass)
Aralia nudicaulis	(wild sarsaparilla)
Geocaulon lividum	(bastard toad-flax)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Peltigera aphthosa	
Dicranum polysetum	(wavy-leaved moss)

SOIL AND SITE

Shepherdia canadensis

Moisture Regime:	submesic - mesic
Nutrient Regime:	poor - medium
Slope Gradient (%):	0-45
* Slope Position:	mid to crest or level
Parent Material:	morainal or (glacio)fluvial
* Soil Texture:	medium to coarse
Coarse Fragments (%):	0-60
Site Index:	Pl 26 (20-35) Sx 27 (18-35)

DISTRIBUTION: common

SXW - HUCKLEBERRY - SOOPOLALLIE (SBSmk2/03)

INTERPRETATIONS

Logging:	- clearcut - attempt to reduce slash accumulations - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
Site preparation:	
Objective	- enhance natural regeneration; improve moisture status; reduce debris; improve planter access
Mechanical	- light drag scarify*; disc trench; mix humus with mineral soil
Prescribed fire	- do not burn - may need to pile and burn
Species choice:	
Preferred Acceptable	- Pl
Brush hazard:	- low
Reforestation:	- conduct a Pl cone survey. If enough seed is present, mechanically treat site.
Concerns:	- mistletoe and gall rust. A mistletoe or gall rust sanitation program will likely be required; consider sanitation thinning on infected Pl stands. - drought

SBSmk2/04

Sb - HUCKLEBERRY - SPIREA

VEGETATION

Shepherdia canadensis

Tree Layer: 30% cover
Lodgepole pine, black spruce, hybrid white spruce

Shrub Layer: 40% cover

Shepherdia canadensis	(soopolallie)
Ledum groenlandicum	(Labrador tea)
Vaccinium membranaceum	(black huckleberry)
Rosa acicularis	(prickly rose)
Vaccinium myrtilloides	(velvet-leaved blueberry)
subalpine fir	
black spruce	

Herb Layer: 15% cover

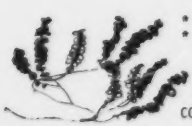
Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Geocaulon lividum	(bastard toad-flax)
Epilobium angustifolium	(fireweed)
Vaccinium caespitosum	(dwarf blueberry)
Gaultheria hispidula	(creeping-snowberry)
Lycopodium complanatum	(ground-cedar)
Oryzopsis asperifolia	(rough-leaved ricegrass)
Orthilia secunda	(one-sided wintergreen)
Calamagrostis canadensis	(bluejoint)

Ledum groenlandicum

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Peltigera aphthosa	
Ptilium crista-castrensis	(knight's plume)
Cladina mitis	
Dicranum polysetum	(wavy-leaved moss)

SOIL AND SITE



Gaultheria hispidula

	Moisture Regime:	submesic - subhygric
	Nutrient Regime:	very poor - poor
*	Aspect:	northerly or flat
*	Slope Gradient (%):	usually less than 10
	Slope Position:	mid to lower or level
*	Parent Material:	glaciofluvial
*	Soil Texture:	medium to coarse
	Coarse Fragments (%):	0-40
	Site Index:	Pl 25 (20-29) Sx 24 (23-26)

COMMENTS: Often associated with compact soils.

DISTRIBUTION: common in some areas

SB - HUCKLEBERRY - SPIREA (SBSmk2/04)

INTERPRETATIONS

Logging:	- clearcut - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
Site preparation:	
Objective	- increase soil temperatures; enhance natural regeneration; reduce debris; improve planter access
Mechanical	- light drag scarify*; mix humus with mineral soil; spot mounding
Prescribed fire	- light broadcast burn (remove L horizon)
Species choice:	
Preferred Acceptable	- Pl
Brush hazard:	- low to moderate (trembling aspen, fireweed) brush competition will likely occur within 3 years of harvesting; sites should be inspected at 3 years to determine if any further treatments are required
Reforestation:	- conduct a Pl cone survey. Planting is rarely required on this unit.
Concerns:	- compact tills - windthrow - perched water table. Only harvest in the winter or dry part of summer. A slightly raised microsite may improve growth on areas which are subhygric. - mistletoe, gall rust

SBSmk2/05

Sxw - OAK FERN

VEGETATION

Oplopanax horridus

Tree Layer: 30% cover
Hybrid white spruce, subalpine fir, lodgepole pine

Shrub Layer: 40% cover

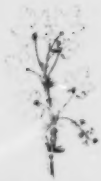
Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Lonicera involucrata	(black twinberry)
Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
subalpine fir	
hybrid white spruce	

Herb Layer: 60% cover

Gymnocarpium dryopteris	(oak fern)
Cornus canadensis	(bunchberry)
Pyrola asarifolia	(rosy wintergreen)
Streptopus amplexifolius	(clasping twistedstalk)
Galium triflorum	(sweet-scented bedstraw)
Linnaea borealis	(twinflower)
Rubus pubescens	(trailing raspberry)
Lycopodium annotinum	(stiff clubmoss)
Equisetum arvense	(common horsetail)
Aralia nudicaulis	(wild sarsaparilla)

Moss Layer: 75% cover

Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)
Mnium spp.	(leafy mosses)



Ribes lacustre

SOIL AND SITE

G. dryopteris

Moisture Regime:	subhygric
Nutrient Regime:	medium - rich (-very rich)
Slope Gradient (%):	0-50
* Slope Position:	usually lower to toe but sometimes level
Parent Material:	variable
Soil Texture:	coarse to medium
Coarse Fragments:	0-50
* Seepage Water:	may be present below 50 cm
Site Index:	Pl 34 (31-37) Sx 26 (21-30)

COMMENTS: Nutrient-rich sites may have patchy cover of Gymnocarpium dryopteris.

DISTRIBUTION: uncommon and not large in area

SXW - OAK FERN (SBSmk2/05)

INTERPRETATIONS

Logging:
- clearcut

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; mound; plow

Prescribed fire
- medium broadcast burn* (remove L horizon); short burning windows will likely necessitate burning in the summer

Species choice:

Preferred
Acceptable
- Sx

Brush hazard:
- moderate to high (black twinberry, fireweed, aspen, thimbleberry)
- brush competition will require post-planting inspections of harvested sites, particularly if sites mechanically treated; these inspections may indicate the need for control of vegetation competition
- pre-harvesting control of apen should be done at least 2 years prior to harvest
- aspen suckering can be a serious problem on these sites

Reforestation:
- vigorous stock should be planted immediately after site preparation

Concerns:
- windthrow
- root rot

SBSmk2/06

Sxw - HORSETAIL

VEGETATION

Tree Layer: 20% cover
Hybrid white spruce

Shrub Layer: 30% cover

Cornus sericea	(red-osier dogwood)
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
subalpine fir	

Cornus sericea

Herb Layer: 65% cover

Equisetum arvense	(common horsetail)
Equisetum sylvaticum	(wood horsetail)
Equisetum pratense	(meadow horsetail)
Rubus pubescens	(trailing raspberry)
Cornus canadensis	(bunchberry)
Mertensia paniculata	(tall bluebells)
Linnaea borealis	(twinflower)
Petasites palmatus	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
Galium triflorum	(sweet-scented bedstraw)
Gymnocarpium dryopteris	(oak fern)
Calamagrostis canadensis	(bluejoint)
Aralia nudicaulis	(wild sarsaparilla)

Rosa acicularis

Moss Layer: 90% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Rhytidiadelphus triquetrus	(electrified cat's-tail moss)

SOIL AND SITE

Equisetum arvense

	Moisture Regime:	hygric
	Nutrient Regime:	medium - rich
*	Slope Gradient (%):	0-5
*	Slope Position:	usually level
*	Parent Material:	usually fluvial
	Soil Texture:	medium to coarse
	Humus Thickness (cm):	3-70
	Coarse Fragments (%):	0-50
*	Seepage Water:	usually present at depths greater than 30 cm
	Site Index:	Sx 26 (20-32)

DISTRIBUTION: common but small in area, and generally on fluvial floodplains

SXW - HORSETAIL (SBSmk2/06)

INTERPRETATIONS

Logging:
- clearcut
- trafficability will be a problem on this s
during the summer
e

Site preparation:

Objective
- reduce debris; prepare raised planting spo
minimize future brush competition; improve
planter access; increase soil temperature

Mechanical
- mound*

Prescribed fire
- broadcast burn

Species choice:

Preferred
Acceptable
Sx

Brush hazard:
- high to very high (black twinberry, firewe
bluejoint, lady fern)
- brush competition will require post-planti
inspections of harvested sites to determin
need for vegetation control
the

Reforestation:
- plant after water table drops below ground
and plant on drier microsites
- use large planting stock
rvel

Concerns:
- water table will likely rise above the gro
surface in the spring causing seedling mor
- flooding
- windthrow hazard is extreme
lity
- herbicide use to control brush competition
conflict with wildlife needs
- this association is critical to the contro
runoff and stream flow
of

5 THE SBSwk2 VARIANT

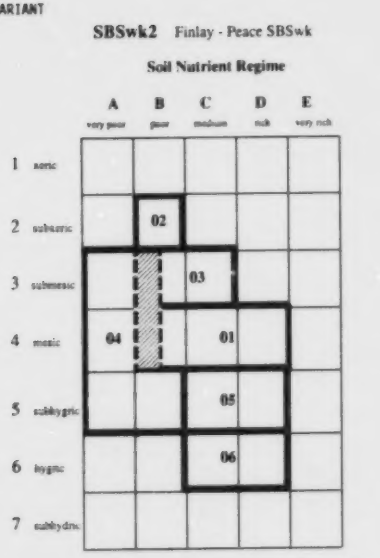


FIGURE 3. Edatopic grid displaying site series in the SBSwk2 variant.

KEY TO SITE UNITS OF THE SBSwk2

1a Canopy composed almost exclusively of lodgepole pine or mixed lodgepole pine and black spruce, white spruce low cover (<5%) or absent; upper slope or level

2a Black spruce present in canopy; soils generally not coarse textured; Cladina spp. (p. 55) low cover (<2%) or absent

SBSwk2/04

2b Black spruce not present in canopy; soils coarse textured; Cladina spp. usually moderate to high cover (>5%)

SBSwk2/02

1b Canopy composed partly or entirely of hybrid white spruce, occasionally in combination with lodgepole pine; slope position variable

3a Canopy usually lodgepole pine and hybrid white spruce; mid to upper slope; Gymnocarpium dryopteris (p. 26)[10] low cover (<1%) or absent

SBSwk2/03

3b Lodgepole pine usually absent from canopy; mid to lower slope or toe, or level, occasionally upper slope on north aspects; Gymnocarpium dryopteris moderate to high cover (>5%)

4a Lower slope; Oplopanax horridus (p. 10) moderate to high cover (>10%)

SBSwk2/05

4b Midslope to toe or level; Oplopanax horridus low cover (<5%) or absent

5a Usually toe of slope or level; seepage water often present; Equisetum spp. (p. 24) moderate to high cover (>10%)

SBSwk2/06

5b Usually midslope, upper slope if north aspect, lower slope if south aspect; seepage water usually absent; Equisetum spp. low cover (<2%) or absent

SBSwk2/01

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[10] Page numbers refer to the publication "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982).

5BSwk2/01

Sxw - OAK FERN

VEGETATION

Tree Layer: 25% cover
Hybrid white spruce, subalpine fir

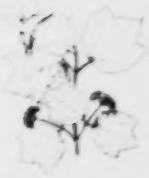
Ribes lacustre

Shrub Layer: 30% cover

Ribes lacustre	(black goose
Viburnum edule	(highbush-cr
Vaccinium membranaceum	(black huck berry)
Oplopanax horridus	(devil's clu anberry)
Alnus viridis ssp. sinuata	(Sitka alder eberry)
[Rubus parviflorus	(thimbleberr b)
[Acer glabrum	(Douglas map)
subalpine fir	y)]
	le)]

Herb Layer: 60% cover

Gymnocarpium dryopteris	(oak fern)
Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided w
Streptopus amplexifolius	(clasping tw
Lycopodium annotinum	(stiff club intergreen)
Rubus pedatus	(five-leaved istedstalk)
Peltaites palmatus	(palmate co oss)
Smilacina racemosa	(false Solom bramble)
Linnaea borealis	(twinflower) tsfoot)
Tiarella trifoliata	(three-leave n's-seal)



Viburnum edule

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed
Ptilium crista-castrensis	(knight's pl feathermoss)
Hylocomium splendens	(step moss) me)

SOIL AND SITE

Moisture Regime:	(subxeric-)
Nutrient Regime:	(poor-) medi
Slope Gradient (%):	0-80 (rare)
* Slope Position:	mid; upper
Aspect	
Parent Material:	moraina1, (g
Soil Texture:	coarse to m
Coarse Fragments (%):	0-60

DISTRIBUTION: common

Gymnocarpium dryopteris

SXW - OAK FERN (SBSwk2/01)

INTERPRETATIONS

Logging:	- clearcut (winter); layout and logging methods should facilitate burning
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature
Mechanical	- patch scarify; mix humus with mineral
Prescribed fire	- broadcast burn* (remove L horizon) - windrow and burn - short burning windows will likely necessitate burning in the summer
Species choice:	
Preferred Acceptable	- Pl, Sx
Brush hazard:	- high (aspen, fireweed, thimbleberry) - post-planting inspections of harvested sites should be carried out to determine the need for vegetation control - pre-harvesting control of aspen should be done at least 2 years prior to harvest - aspen suckering can be a serious problem on these sites
Reforestation:	- vigorous stock should be planted immediately after site preparation
Concerns:	- root rot (if managing for Sx) - windthrow

SBSwk2/02

P1 - HUCKLEBERRY - CLADINA

VEGETATION

V. membranaceum

Tree Layer: 40% cover
Lodgepole pine

Shrub Layer: 60% cover

Vaccinium membranaceum	(black huckleberry)
Alnus viridis ssp. *sinuata*	(Sitka alder)
subalpine fir	
hybrid white spruce	

Herb Layer: 15% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Pyrola chlorantha	(green wintergreen)

Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Cladina spp.	
Peltigera aphthosa	
Dicranum spp.	
Barbilophozia spp.	

A. viridis ssp. *sinuata*

SOIL AND SITE

	Moisture Regime:	subxeric
	Nutrient Regime:	poor
*	Slope Gradient (%):	0-6 (usually 0)
*	Slope Position:	level or upper
*	Parent Material:	(glacio)fluvial
*	Soil Texture:	coarse
	Coarse Fragments (%):	40-60

COMMENTS: Limited data for this site series.

DISTRIBUTION: uncommon

Cladina spp.

Pl - HUCKLEBERRY - CLADINA (SBSwk2/02)

INTERPRETATIONS

Logging:
- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals

Site preparation:

Objective
- enhance natural regeneration; improve moisture status; reduce debris; improve planter access

Mechanical
- light drag scarify if logged in winter and cone crop survey indicates a good supply of seeds; disc trench; mix humus with mineral soil

Prescribed fire
- do not burn

Species choice:

Preferred
Acceptable
- Pl

Brush hazard:
- low

Reforestation:
- conduct a Pl cone survey to see. If cones are insufficient, plant Pl stock.

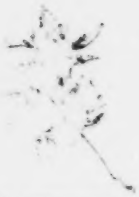
Concerns:
- mistletoe
- drought

SBSwk2/03

Srw - HUCKLEBERRY - HIGHBUSH-CRANBERRY

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, hybrid white spruce



V. membranaceum

Shrub Layer: 50% cover

Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Spiraea betulifolia	(birch-leaved spirea)
Alnus viridis ssp. sinuata	(Sitka alder)
Ribes lacustre	(black gooseberry)
Sorbus scopulina	(western mountain-ash)
subalpine fir	
lodgepole pine	

Herb Layer: 60% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Lycopodium annotinum	(stiff clubmoss)
Rubus pedatus	(five-leaved bramble)
Linnaea borealis	(twinflower)
Smilacina racemosa	(false Solomon's-seal)
Pyrola chlorantha	(green wintergreen)
Arnica cordifolia	(heart-leaved arnica)

Moss Layer: 95% cover

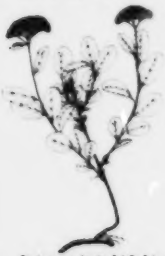
Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)

SOIL AND SITE

Moisture Regime:	submesic
Nutrient Regime:	poor - medium
Slope Gradient (%):	0-75
* Slope Position:	mid to upper; or level
Parent Material:	glaciofluvial, morainal, colluvial
* Soil Texture:	moderately coarse to coarse
Coarse Fragments (%):	0-60

DISTRIBUTION: common

Viburnum edule



Spiraea betulifolia

SXW - HUCKLEBERRY - HIGHBUSH-CRANBERRY (SBSwk2/03)

INTERPRETATIONS

Logging:	- clearcut
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access
Mechanical	- patch scarify; disc trench; mix humus with mineral
Prescribed fire	- broadcast burn (remove L horizon) - avoid burning sites with a thin humus layer (less than 6 cm)
Species choice:	
Preferred Acceptable	- Pl, Sx
Brush hazard:	- moderate (fireweed, trembling aspen) - pre-harvesting control of aspen should be done at least 2 years prior to harvest - aspen suckering can be a serious problem on these sites - moderate brush competition will likely occur within 3 years of harvesting; an inspection at 3 years will indicate if any further treatment is required
Reforestation:	
Concerns:	- drought

SBSwk2/04

Sb - HUCKLEBERRY - CLUBMOSS

VEGETATION

Tree Layer: 25% cover
Hybrid white spruce, lodgepole pine, black spruce

black spruce

Shrub Layer: 50% cover

Rosa acicularis	(prickly rose)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Alnus viridis ssp. sinuata	(Sitka alder)
Ribes lacustre	(black gooseberry)
Sorbus scopulina	(western mountain-ash)
Ledum groenlandicum	(Labrador tea)
subalpine fir	
hybrid white spruce	
black spruce	

Herb Layer: 45% cover

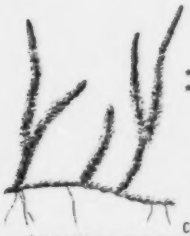
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Equisetum scirpoides	(dwarf scouring-rush)
Orthilia secunda	(one-sided wintergreen)
Epilobium angustifolium	(fireweed)
Lycopodium annotinum	(stiff clubmoss)
Mitella nuda	(common mitrewort)
Gymnocarpium dryopteris	(oakfern)
Rubus pubescens	(trailing raspberry)
Petasites palmatus	(palmate coltsfoot)
Rubus pedatus	(five-leaved bramble)

Equisetum scirpoides

Moss Layer: 60% cover

Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)
Peltigera aphthosa	

SOIL AND SITE



Lycopodium annotinum

Moisture Regime:	submesic - subhygric
Nutrient Regime:	poor - medium
* Aspect:	northerly or flat
* Slope Gradient (%):	usually less than 25
Slope Position:	mid to upper or level
Parent Material:	glacio(fluvial) or morainal
Soil Texture:	moderately fine to coarse
Coarse Fragments (%):	0-85
Site Index:	Pl 22 Sx 22 (19-26)

COMMENTS: Often associated with compact soils.

DISTRIBUTION: common in some areas

SB - HUCKLEBERRY - CLUBMOSS (SBSwk2/04)

INTERPRETATIONS

Logging:
- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
- only harvest in the winter or dry part of summer

Site preparation:

Objective
- enhance natural regeneration; reduce debris; improve planter access

Mechanical
- light drag scarify*; mix humus with mineral soil; spot mounding

Prescribed fire
- light broadcast burn (remove L horizon)

Species choice:

Preferred
- Pl

Acceptable
- Sx

Brush hazard:
- low to moderate (trembling aspen, fireweed)
- brush competition will likely occur within 3 years of harvesting; sites should be inspected at 3 years to determine if any further treatment is required

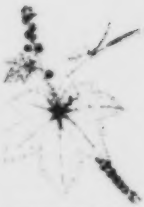
Reforestation:

Concerns:
- compact till
- windthrow
- perched water table; a slightly raised microsite may improve growth on areas which are subhygric
- mistletoe, gall rust (if managing for Pl)
- root rot (if managing for Sx)
- trafficability problems

SBSwk2/05

Srw - DEVIL'S CLUB

VEGETATION



Oplopanax horridus

Tree Layer: 15% cover
Hybrid white spruce, subalpine fir

Shrub Layer: 75% cover

Oplopanax horridus	(devil's club)
Rubus parviflorus	(thimbleberry)
Ribes lacustre	(black gooseberry)
subalpine fir	

Herb Layer: 80% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Tiarella trifoliata	three-leaved foamflower)
Clintonia uniflora	(queen's cup)
Streptopus amplexifolius	(clasping twistedstalk)
Cornus canadensis	(bunchberry)
Osmorhiza chilensis	(sweet-cicely)
Lycopodium annotinum	(stiff clubmoss)
Smilacina racemosa	(false Solomon's-seal)
Rubus pubescens	(trailing raspberry)

Rubus parviflorus

Moss Layer: 70% cover

Ptilium crista-castrensis	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)
Mnium spp.	(leafy mosses)

SOIL AND SITE

Moisture Regime:	(mesic) - subhygric
Nutrient Regime:	medium - rich
Slope Gradient (%):	5-35
• Slope Position:	lower
Parent Material:	variable
Soil Texture:	variable
Coarse Fragments (%):	5-80
• Seepage Water:	may be present

DISTRIBUTION: common

Gymnocarpium dryopteris

SXW - DEVIL'S CLUB (SBSwk2/05)

INTERPRETATIONS

Logging:	- clearcut (winter); layout and logging methods should facilitate burning - inspect the site to determine if there is a fine textured soil, in which case the use of low ground pressure vehicles to prevent compaction is recommended
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature
Mechanical	- patch scarify; mound; plow
Prescribed fire	- broadcast burn* - short burning windows will likely necessitate burning in the summer
Species choice:	
Preferred Acceptable	- Sx
Brush hazard:	- very high (fireweed, thimbleberry) - post-planting inspections of harvested sites should be carried out to determine the need for vegetation control - pre-harvesting control of aspen should be done at least 2 years prior to harvest
Reforestation:	- large vigorous stock should be planted immediately after site preparation
Concerns:	- windthrow - root rot

SBSwk2/06

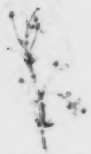
Srw - HORSETAIL

VEGETATION

Tree Layer: 15% cover
Hybrid white spruce, subalpine fir

Shrub Layer: 25% cover

Ribes lacustre	(black gooseberry)
Lonicera involucrata	(black twinberry)
Viburnum edule	(highbush-cranberry)
Cornus sericea	(red-osier dogwood)
Rosa acicularis	(prickly rose)
subalpine fir	



Ribes lacustre

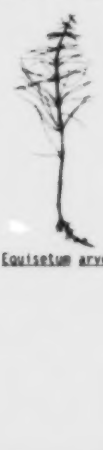
Herb Layer: 75% cover

Equisetum arvense	(common horsetail)
Equisetum pratense	(meadow horsetail)
Cornus canadensis	(bunchberry)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Mitella nuda	(common mitrewort)
Gymnocarpium dryopteris	(oak fern)
Mertensia paniculata	(tall bluebells)
Galium triflorum	(sweet-scented bedstraw)
Streptopus amplexifolius	(clasping twistedstalk)
Smilacina racemosa	(false Solomon's-seal)
Heracleum sphondylium	(cow-parsnip)
Rubus pedatus	(five-leaved bramble)
Aconitum delphiniifolium	(mountain monkshood)
Aralia nudicaulis	(wild sarsaparilla)

Cornus sericea

Moss Layer: 50% cover

Hylocomium splendens	(step moss)
Mnium spp.	(leafy mosses)
Ptilium crista-castrensis.	(knight's plume)
Pleurozium schreberi	(red-stemmed feathermoss)



Equisetum arvense

SOIL AND SITE

Moisture Regime:	(subhygric) - hygric
Nutrient Regime:	medium to rich
Slope Gradient (%):	0-6
Slope Position:	(lower) - toe or level
Parent Material:	(glacio)fluvial
Soil Texture:	medium to moderately coarse
Coarse Fragments (%):	0-56
Seepage Water:	often present

DISTRIBUTION: uncommon west of the Rocky Mountains; common east of the Rocky Mountains

SXW - HORSETAIL (SBSwk2/06)

INTERPRETATIONS

Logging:

- clearcut

Site preparation:

Objective

- reduce debris; prepare raised planting s
minimize future brush competition; impro pots;
planter access; increase soil temperatur ve
e

Mechanical

- mound*
- trafficability will be a problem on this site
during the summer

Prescribed fire

- broadcast burn

Species choice:

Preferred
Acceptable

- Sx

Brush hazard:

- very high (black twinberry, fireweed, wi
bluejoint)
- post-planting inspections of harvested s llows,
should be carried out to determine the n tes
vegetation control
eed for

Reforestation:

- plant after water table drops below groun
and plant on drier microsites
- use large vigorous planting stock d level

Concerns:

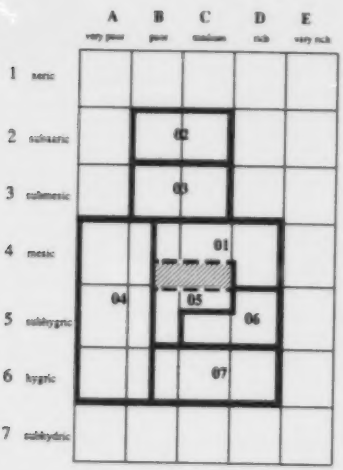
- this association is critical to the contr
runoff and stream flow
- herbicide use to control brush competitio ol of
conflict with fish and wildlife needs
- windthrow n may
- root rot
- compaction
- high water table; water table will likely
above the ground surface in the spring ca rise
seedling mortality
using

NOTES

6 THE SBSwk3 VARIANT

SBSwk3 Takla SBSwk

Soil Nutrient Regime



Site Series
01 Sxw - Oak fern
02 SxwFd - Purple peavine
03 Sxw - Huckleberry - Highbush-cranberry
04 Sb - Labrador tea
05 Sxw - Twinberry - Coltsfoot
06 Sxw - Devil's club
07 Sxw - Horsetail

FIGURE 4. Edatopic grid displaying site series in the SBSwk3 variant.

KEY TO SITE UNITS OF THE SBSwk3

1a Canopy dominated by Douglas-fir; Amelanchier alnifolia (p. 7)[11] p
slope position upper or level resent;

SBSwk3/02

1b Canopy dominated by other species; Amelanchier alnifolia absent;
position variable slope

2a Canopy dominated by a combination of lodgepole pine and black
slope gradient less than 10%, often 0 (i.e., flat); Aulacomni spruce;
(p. 58) present m palustre

SBSwk3/04

2b Canopy dominated by hybrid white spruce, sometimes in combina
lodgepole pine; slope gradient variable; Aulacomnium palustre ion with
absent usually

3a Level or depression; parent material fluvial or lacustri
Equisetum spp. (p. 24) abundant (usually >30% cover) e;

SBSwk3/07

3b Slope position variable; parent material variable; Equis
cover (<2%) or absent tum spp. low

4a Slope position mid to lower (occasionally upper on n
aspects); Oplopanax horridus (p. 10) abundant (usual rth
y >15% cover)

SBSwk3/06

4b Slope position variable; Oplopanax horridus low cove
absent (<3%) or

5a Gymnocarpium dryopteris (p. 26) moderate to high
(usually >5%) cover

SBSwk3/01

5b Gymnocarpium dryopteris low cover (usually <2%)
r absent

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[11] Page numbers refer to the publication "Some Common Plants of the
Spruce Zone" (Pojar et al. 1982). ub-Boreal

6a Usually mid to upper slope; lodgepole pine usually present in the canopy; Rubus pubescens (p. 18) usually very low cover (<1%) or absent

SBSwk3/03

6b Usually mid to lower slope; lodgepole pine usually absent from the canopy; Rubus pubescens usually low to moderate cover (>1%)

SBSwk3/05

SBSwk3/01

Sxw - OAK FERN

VEGETATION

Lonicera involucrata

Tree Layer: 45% cover
Hybrid white spruce, lodgepole pine, subalpine fir

Shrub Layer: 45% cover

Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Rubus parviflorus	(thimbleberry)
Sorbus scopulina	(western mountain-ash)
subalpine fir	
hybrid white spruce	

Herb Layer: 80% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
Lycopodium annotinum	(stiff clubmoss)
Petasites palmatus	(palmate coltsfoot)
Linnaea borealis	(twinflower)
Orthilia secunda	(one-sided wintergreen)
Smilacina racemosa	(false Solomon's-seal)

Ribes lacustre

Moss Layer: 75% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Barbilophozia lycopodioides	(common leafy liverwort)

SOIL AND SITE

Moisture Regime:	mesic
Nutrient Regime:	medium
Slope Gradient (%):	13 (0-35; usually less than 20)
* Slope Position:	mid (lower to upper)
Parent Material:	(glacio)fluvial or morainal
* Soil Texture:	usually medium to moderately coarse
Coarse Fragments (%):	40 (13-61)
Site Index:	Bl 24 (23-28)
	Pl 26 (17-32)
	Sx 27 (24-32)

Gymnocarpium dryopteris

DISTRIBUTION: common

SXW - OAK FERN (SBSwk3/01)

INTERPRETATIONS

Logging:
- clearcut (winter); layout and logging methods should facilitate burning

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; mix humus with mineral

Prescribed fire
- broadcast burn* (remove L horizon)
- windrow and burn
- short burning windows will likely necessitate burning in the summer

Species choice:

Preferred
Acceptable
- Pl, Sx

Brush hazard:
- high (trembling aspen, thimbleberry, fireweed, black twinberry)
- brush competition will require post-planting inspections of harvested sites, particularly if sites mechanically treated; these inspections may indicate the need for control of vegetation competition
- pre-harvesting control of aspen should be done at least 2 years prior to harvest
- aspen suckering can be a serious problem on these sites

Reforestation:
- vigorous stock should be planted immediately after site preparation

Concerns:
- root rot (if managing for Sx)
- windthrow

SBSwk3/02

SxwFd - PURPLE PEAVINE

Douglas-fir

Amelanchier alnifolia

Lathyrus nevadensis

VEGETATION

Tree Layer: 80% cover
Douglas-fir, (hybrid white spruce)

Shrub Layer: 20% cover

Amelanchier alnifolia	(saskatoon)
Spiraea betulifolia	(birch-leaved spirea)
Cornus sericea	(red-osier dogwood)
Ribes lacustre	(black gooseberry)
Acer glabrum	(Douglas maple)
subalpine fir	

Herb Layer: 35% cover

Lathyrus nevadensis	(purple peavine)
Aralia nudicaulis	(wild sarsaparilla)
Clintonia uniflora	(queen's cup)
Thalictrum occidentale	(western meadowrue)
Orthilia secunda	(one-sided wintergreen)
Aster conspicuus	(showy aster)
Smilacina racemosa	(false Solomon's-seal)
Goodyera oblongifolia	(rattlesnake-plantain)
Disporum hookeri	(Hooker's fairybells)

Moss Layer: 30% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)

SOIL AND SITE

Moisture Regime:	subxeric - xeric
Nutrient Regime:	poor - medium
Slope Gradient (%):	21 (2-40)
* Slope Position:	upper or level
* Parent Material:	morainal or colluvial
* Soil Texture:	coarse
Coarse Fragments (%):	55 (50-59)
Site Index:	Fd 27
	Pl 23 (16-30)

DISTRIBUTION: uncommon, and usually small in size

SXWFD - PURPLE PEAVINE (SBSwk3/02)

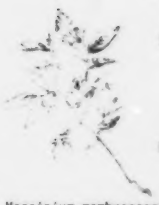
INTERPRETATIONS

Management objectives: - every effort should be made to not harvest these areas because they represent the northernmost extent of Douglas-fir and they represent a unique ecosystem that should be preserved for research

SBSwk3/03

Sxw - HUCKLEBERRY - HIGHBUSH-CRANBERRY

VEGETATION



Vaccinium membranaceum

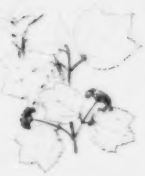
Tree Layer: 40% cover
Lodgepole pine, hybrid white spruce, subalpine fir

Shrub Layer: 35% cover

Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Ribes lacustre	(black gooseberry)
Spiraea betulifolia	(birch-leaved spirea)
subalpine fir	

Herb Layer: 25% cover

Smilacina racemosa	(false Solomon's-seal)
Linnaea borealis	(twinflower)
Orthilia secunda	(one-sided wintergreen)
Cornus canadensis	(bunchberry)
Clintonia uniflora	(queen's cup)
Arnica cordifolia	(heart-leaved arnica)
Epilobium angustifolium	(fireweed)



Viburnum edule

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)

SOIL AND SITE

Moisture Regime:	submesic - (mesic)
Nutrient Regime:	poor - medium
Slope Gradient (%):	11 (4-20)
Slope Position:	variable
Parent Material:	morainal or (glacio) fluvial, occasionally colluvial
* Soil Texture:	coarse - (medium)
* Coarse Fragments (%):	43 (8-85; usually more than 30)
Site Index:	Bl 23 (17-28) Pl 28 (26-31) Sx 27 (24-29)

DISTRIBUTION: fairly common

Smilacina racemosa

SXW - HUCKLEBERRY - HIGHBUSH-CRANBERRY (SBSwk3/03)

INTERPRETATIONS

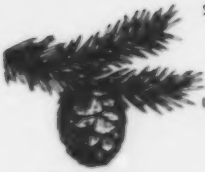
Logging:	- clearcut - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
Site preparation:	
Objective	- enhance natural regeneration; reduce debris; prepare planting spots; improve moisture status; improve planter access; protect thin humus forms
Mechanical	- drag scarify*; patch scarify; disc trench
Prescribed fire	- light broadcast burn (remove L horizon) - avoid burning sites with a thin humus layer (less than 6 cm)
Species choice:	
Preferred	- Pl
Acceptable	- Sx
Brush hazard:	- moderate (fireweed, trembling aspen, highbush-cranberry) - brush competition will likely occur within 3 years of harvesting; sites should be inspected at 3 years to determine if any further treatment is required - pre-harvesting control of aspen should be done at least 2 years prior to harvest - aspen suckering can be a serious problem on these sites
Reforestation:	
Concerns:	- drought - windthrow

SBSwk3/04

Sb - LABRADOR TEA

VEGETATION

Tree Layer: 15% cover
Black spruce, lodgepole pine



Black spruce

Shrub Layer: 45% cover

Salix spp.	(willows)
Lonicera involucrata	(black twinberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)

Herb Layer: 95% cover

Equisetum arvense	(common horsetail)
Rubus pubescens	(trailing raspberry)
Fragaria virginiana	(wild strawberry)
Elymus glaucus	(blue wildrye)
Galium boreale	(northern bedstraw)

Moss Layer: 15% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Aulacomnium palustre	(glow moss)

Salix spp.

SOIL AND SITE

	Moisture Regime:	submesic - subhygric
	Nutrient Regime:	very poor - poor
*	Aspect:	northerly or flat
*	Slope Gradient (%):	usually less than 10
	Slope Position:	mid to lower or level
*	Parent Material:	glaciofluvial
*	Soil Texture:	medium to coarse
	Coarse Fragments (%):	0-40
	Site Index:	Pl 20 Sx 23

Equisetum arvense

COMMENTS: Often associated with compact soils.

DISTRIBUTION: rare

SB - LABRADOR TEA (SBSwk3/04)

INTERPRETATIONS

Logging:

- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
- only harvest in the winter or dry part of summer

Site preparation:

Objective
- increase soil temperatures; enhance natural regeneration; reduce debris; improve planter access

Mechanical
- light drag scarify*; mix humus with mineral soil; spot mounding
- a slightly raised microsite may improve growth on areas which are subhygric

Prescribed fire
- light broadcast burn (remove L horizon)

Species choice:

Preferred
Acceptable
- Pl

Brush hazard:

- moderate (trembling aspen, fireweed, willows, black twinberry)
- brush competition will likely occur within 3 years of harvesting; sites should be inspected at 3 years to determine if any further treatments are required

Reforestation:

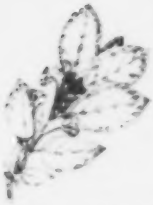
Concerns:

- compact till
- windthrow
- perched water table
- trafficability problems
- mistletoe, gall rust

SBSwk3/05

Sxw - TWINBERRY - COLTSFOOT

VEGETATION



Lonicera involucrata

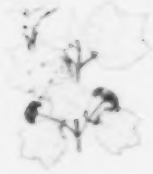
Tree Layer: 35% cover
Hybrid white spruce, subalpine fir, (trembling aspen)

Shrub Layer: 25% cover

Lonicera involucrata	(black twinberry)
Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Rubus parviflorus	(thimbleberry)
Rosa acicularis	(prickly rose)
[Cornus sericea	red-osier dogwood)]
subalpine fir	
hybrid white spruce	

Herb Layer: 30% cover

Cornus canadensis	(bunchberry)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Thalictrum occidentale	(western meadowrue)
Smilacina racemosa	(false Solomon's-seal)
Petasites palmatus	(palmate coltsfoot)
Mitella nuda	(common mitrewort)
Osmorhiza chilensis	(sweet-cicely)
Pyrola asarifolia	(rosy wintergreen)



Viburnum edule

Moss Layer: 85% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Rhytidiadelphus triquetrus	(electrified cat's-tail moss)

SOIL AND SITE

Petasites palmatus

Moisture Regime:	(mesic) - subhygric
Nutrient Regime:	poor - medium
• Aspect:	generally not northerly
Slope Gradient (%):	15 (2-30)
• Slope Position:	mid (upper to lower)
Parent Material:	glaciofluvial (and morainal)
• Soil Texture:	moderately coarse to medium
Coarse Fragments (%):	36 (24-46)
Site Index:	Bl 17 (14-24)
	Pl 20 (14-26)
	Sx 27 (23-36)

DISTRIBUTION: uncommon

SXW - TWINBERRY - COLTSFOOT (SBSmk3/05)

INTERPRETATIONS

Logging:
- clearcut

Site preparation:

Objective
- reduce debris; prepare planting spots; minim
future brush competition; improve planter ac
protect thin humus forms

Mechanical
- patch scarify; mix humus with mineral

Prescribed fire
- broadcast burn* (remove L horizon)
- windrow and burn
- avoid burning sites with a thin humus layer
than 6 cm)

Species choice:

Preferred
Acceptable
- Sx, Pl

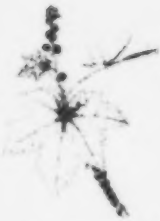
Brush hazard:
- high (aspen, fireweed, thimbleberry, black
twinberry)
- post-planting inspections of harvested sites
should be carried out to determine the need
vegetation control
- pre-harvesting control of aspen should be don
least 2 years prior to harvest
- aspen suckering may be a problem on these si

Reforestation:
- vigorous stock should be planted immediately
after site preparation

Concerns:
- root rot (if managing for Sx)
- windthrow

SBSwk3/06

Sxw - DEVIL'S CLUB



Oplopanax horridus

VEGETATION

Tree Layer: 35% cover
Hybrid white spruce, subalpine fir, (lodgepole pine)

Shrub Layer: 60% cover

Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Rubus parviflorus	(thimbleberry)
Viburnum edule	(highbush-cranberry)
Vaccinium membranaceum	(black huckleberry)
Lonicera involucrata	(black twinberry)
subalpine fir	

Herb Layer: 30% cover

Gymnocarpium dryopteris	(oak fern)
Streptopus amplexifolius	(clasping twistedstalk)
Actaea rubra	(baneberry)
Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
Galium triflorum	(sweet-scented bedstraw)
Tiarella trifoliata	(three-leaved foamflower)
Dryopteris assimilis	(spiny wood fern)
Lycopodium annotinum	(stiff clubmoss)

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feather moss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
[Mnium spp.	(leafy mosses)]

Rubus parviflorus

SOIL AND SITE

Moisture Regime:	(mesic) - hygric
Nutrient Regime:	medium - rich
Slope Gradient (%):	26 (5-49)
* Slope Position:	usually mid to lower; may be upper on north aspects
Parent Material:	morainal or (glacio)fluvial
Soil Texture:	variable
Coarse Fragments (%):	34 (10-66)
Site Index:	Bl 26 (23-31)
	Pl 25 (21-31)
	Sx 28 (25-34)

Gymnocarpium dryopteris

DISTRIBUTION: fairly common

SXW - DEVIL'S CLUB (SBSwk3/06)

INTERPRETATIONS

Logging:
- clearcut (winter); layout and logging methods should facilitate burning
- inspect the site to determine if there is a fine textured soil, in which case the use of low ground pressure vehicles to prevent compaction is recommended

Site preparation:

Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature
Mechanical	- patch scarify; mound*; plow - natural raised microsites provide the best planting spots on these sites
Prescribed fire	- broadcast burn* - short burning windows will likely necessitate burning in the summer - a secondary treatment such as mounding may be required after burning to meet site preparation objectives

Species choice:

Preferred	- Sx
Acceptable	- Bl

Brush hazard:
- very high (fireweed, thimbleberry, black twinberry)
- post-planting inspections of harvested sites should be carried out to determine the need for vegetation control

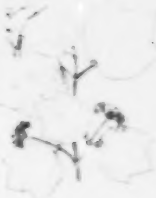
Reforestation:
- use large vigorous planting stock

Concerns:
- windthrow
- root rot

SBSwk3/07

Sxw - HORSETAIL

VEGETATION



Viburnum edule

Tree Layer: 25% cover
Hybrid white spruce, (subalpine fir, black spruce)

Shrub Layer: 35% cover

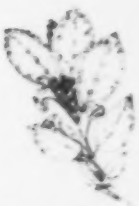
Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Rosa acicularis	(prickly rose)
Ribes lacustre	(black gooseberry)
Salix spp.	(willow)
Rubus idaeus	(red raspberry)
Vaccinium membranaceum	(black huckleberry)

Herb Layer: 60% cover

Equisetum spp. (arvense, sylvaticum)	(horsetail)
Cornus canadensis	(bunchberry)
Potentilla palmatus	(palmate-leaved cinquefoil)
Mitella nuda	(common coltsfoot)
Gallium boreale	(northern bedstraw)
Rubus pubescens	(trailing raspberry)
Linnaea borealis	(twinflower)
Rubus nedatus	(five-leaved bramble)

Moss Layer: 50% cover

Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(red-stem moss)
Pleurozium schreberi	(leafy mosses)]
[Mnium spp.	



Lonicera involucrata

SOIL AND SITE

	Moisture Regime:	hygric
	Nutrient Regime:	medium
*	Slope Gradient (%):	2 (0-5) - rich
*	Slope Position:	level o
*	Parent Material:	fluvial depression
	Soil Texture:	coarse or lacustrine
	Coarse Fragments (%):	variable to fine
	Site Index:	

Equisetum arvense

DISTRIBUTION: common but generally small in size

SXW - HORSETAIL (SBSwk3/07)

INTERPRETATIONS

Logging:
- clearcut
- trafficability will be a problem on this site during the summer

Site preparation:

Objective
- reduce debris; prepare raised planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- mound*

Prescribed fire
- broadcast burn

Species choice:

Preferred
Acceptable
- Sx

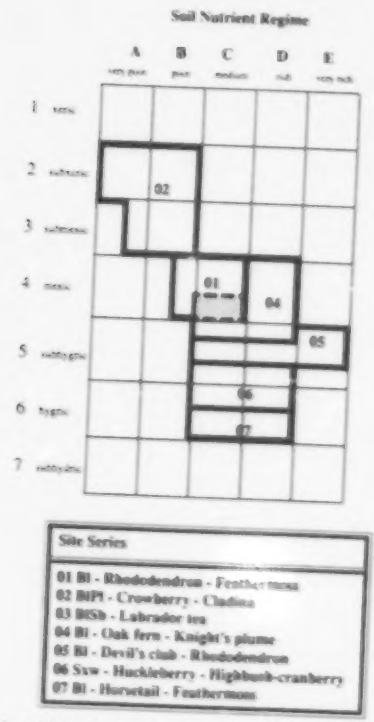
Brush hazard:
- very high (black twinberry, fireweed, willows, bluejoint)
- post-planting inspections of harvested sites should be carried out to determine the need for vegetation control

Reforestation:
- plant after water table drops below ground level and plant on drier microsites
- use large vigorous planting stock

Concerns:
- windthrow
- root rot
- compaction
- this association is critical to the control of runoff and stream flow
- water table will likely rise above the ground surface in the spring causing seedling mortality
- herbicide use to control brush competition may conflict with fish and wildlife needs

7 THE ESSFmv3 VARIANT

ESSFmv3 Omineca ESSFmv



Site Series
01 Bl - Rhododendron - Feathermoss
02 BlPl - Crowberry - Cladina
03 BlSb - Labrador tea
04 Bl - Oak fern - Knight's plume
05 Bl - Devil's club - Rhododendron
06 Sxw - Huckleberry - Highbush-cranberry
07 Bl - Horsetail - Feathermoss

FIGURE 5. Edatopic grid displaying site series in the ESSFmv3 variant.

KEY TO SITE UNITS OF THE F>SFmv3

1a Canopy dominated by black spruce and lodgepole pine; sites level

ESSFmv3/03

1b Canopy dominated by lodgepole pine or Engelmann spruce, black spruce minor or absent

2a Canopy dominated by lodgepole pine, Engelmann spruce low cover (>5% of canopy) or absent

ESSFmv3/02

2b Canopy dominated by Engelmann spruce or subalpine fir, lodgepole pine low cover (<5% of canopy) or absent

3a Site level or nearly so (slope 0-5%); water table near surface; horsetails (Equisetum spp., p. 24)[12] moderately abundant (>10%)

ESSFmv3/07

3b Site level or sloping; water table usually below 50 cm; horestails low cover (<2%) or absent

4a Soils organic rather than mineral; usually lower slope; Oplopanax horridus (p. 10) lower cover (<2%) or absent

ESSFmv3/06

4b Soils mineral; slope position variable; Oplopanax horridus cover variable

5a Usually lower slope or level; Oplopanax horridus low to moderate cover (>5%)

ESSFmv3/05

5b Upper to lower slope; Oplopanax horridus very low cover (<1%) or absent

6a Mid to lower slope; Gymnocarpium dryopteris (p. 26) moderate cover (>15%)

ESSFmv3/04

6b Mid to upper slope; Gymnocarpium dryopteris low cover (<1%) or absent

ESSFmv3/01

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12 Page numbers refer to the publication "Some Common Plants of the Sub-Boreal Spruce Zone" (Pojar et al. 1982).

ESSFmv3/01

BI - RHODODENDRON - FEATHERMOSS

VEGETATION

V. membranaceum

Tree Layer: 30% cover
Engelmann spruce, subalpine fir

Shrub Layer: 45% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododendron)
Ribes lacustre	(black gooseberry)
Sorbus scopulina	(western mountain-ash)
[Alnus viridis ssp. sinuata	(Sitka alder)]
[Vaccinium ovalifolium	(oval-leaved blueberry)]

subalpine fir
Engelmann spruce

Herb Layer: 25% cover

Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Lycopodium annotinum	(stiff clubmoss)
Arnica cordifolia	(heart-leaved arnica)
Rubus pedatus	(five-leaved bramble)
Linnaea borealis	(twinflower)
Streptopus amplexifolius	(clasping twisted stalk)

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Peltigera aphthosa	
Hylocomium splendens	(step moss)

subalpine fir

Rhododendron albiflorum

SOIL AND SITE

Moisture Regime:	(submesic-) mesic (-subhygric)
Nutrient Regime:	medium (-rich)
Slope Gradient (%):	26 (2-60)
* Slope Position:	(lower-) mid (-upper)
Parent Material:	usually morainal or glaciofluvial occ. colluvial
Soil Texture:	variable; usually medium
Coarse Fragments (%):	32 (3-77)
Site Index:	Se 25 (17-33)
	Pl 25 (17-32)
	Bl 23 (15-33)

Sorbus scopulina

DISTRIBUTION: common and widespread

Bl - RHODODENDRON - FEATHERMOSS (ESSFmv3/01)

INTERPRETATIONS

Logging:
- clearcut(winter); log on firm deep snowpack if considering use of advanced regeneration

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; piling
- low ground pressure vehicles should be considered if mechanical site preparation is conducted on medium- to fine-textured soils

Prescribed fire
- broadcast burn* (remove L horizon) or windrow and burn
- short burning windows will likely necessitate burning in the summer
- beware of burning sites with humus depths less than 7 cm

Species choice:

Preferred
- Se

Acceptable
- Bl

Brush hazard:
- high (white-flowered rhododendron, fireweed)
- post-planting inspections of harvested sites should be carried out to determine the need for vegetation control

Reforestation:
- use of advanced Se and Bl regeneration less than 1 m tall should be considered if it is abundant and well distributed. Advanced regeneration greater than 1 m tall will be difficult to protect and should be removed during logging.
- plant large stock in summer
- avoid planting in depressions and frost pockets

Concerns:
- windthrow
- heavy snowpack
- frost
- snowmold

ESSFmv3/02

BlPl - CROWBERRY - CLADINA

VEGETATION

lodgepole pine

Tree Layer: 25% cover
Lodgepole pine, (Engelmann spruce)

Shrub Layer: 35% cover

Vaccinium membranaceum	(black huckleberry)
Rhododendron albiflorum	(white-flowered rhododend
Alnus viridis ssp. sinuata	(Sitka alder)
Subalpine fir	

Herb Layer: 40% cover

Empetrum nigrum	(crowberry)
Lycopodium ssp. [annotinum, complanatum	(clubmosses)
Cornus canadensis	(bunchberry)
Epilobium angustifolium	(fireweed)
Orthilia secunda	(one-sided wintergreen)
Chimaphila umbellata	(prince's pine)

Empetrum nigrum

Moss Layer: 75% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Polytrichum juniperinum	(juniper haircap moss)
Cladina spp.	
Cladonia spp.	

SOIL AND SITE

Moisture Regime:	subxeric - submesic
Nutrient Regime:	poor
Slope Gradient (%):	17 (8-33)
* Slope Position:	mid to upper (or level)
Parent Material:	variable
* Soil Texture:	moderately coarse to coar
Coarse Fragments (%):	33 (23-50)
Site Index:	Pl 24 (18-31)

DISTRIBUTION: rare

Cladina spp.

BLPL - CROWBERRY - CLADINA (ESSFmv3/02)

INTERPRETATIONS

Logging:

- clearcut
- attempt to reduce slash accumulations when logging to help meet site preparation objectives
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals

Site preparation:

Objective
- enhance natural regeneration; reduce debris; improve planter access; protect thin humus forms

Mechanical
- light drag scarify*; mix humus with mineral soil

Prescribed fire
- do not burn

Species choice:

Preferred
Acceptable
- Pl

Brush hazard:
- low

Reforestation:
- conduct a Pl cone survey. If cones are insufficient and competition is low, plant Pl stock without site preparation.

Concerns:
- drought
- heavy snowpack
- large silviculture expenditures on these sites may be difficult to justify because of their low productivity, and management must ensure that productivity is not further reduced

ESSFmv3/03

B\Sb - LABRADOR TEA

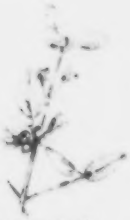
VEGETATION

Tree Layer: % cover
Lodgepole pine, black spruce

Shrub Layer: % cover
Shepherdia canadensis (soopolallie)
Ledum groenlandicum (Labrador tea)
Rhododendron albiflorum (white-flowered rhododendron)
black spruce
Engelmann spruce
subalpine fir

black spruce

Herb Layer: % cover
Cornus canadensis (bunchberry)
Arnica cordifolia (heart-leaved arnica)
Linnaea borealis (twinflower)
Vaccinium vitis-idaea (lingonberry)
Vaccinium caespitosum (dwarf blueberry)
Gaultheria hispidula (creeping-snowberry)
Empetrum nigrum (crowberry)



S. canadensis

Moss Layer: % cover
Pleurozium schreberi (red-stemmed feathermoss)
Ptilium crista-castrensis (knight's plume)
Hylocomium splendens (step moss)

SOIL AND SITE

Moisture Regime:	submesic - subhygric
Nutrient Regime:	poor
* Slope Gradient (%):	0
* Slope Position:	level
* Parent Material:	morainal
Soil Texture:	variable
Coarse Fragments (%):	51 (24-78)
Site Index:	Pl 23 (on limited data) Sb 19 (on limited data) Se 17 (on limited data)

COMMENTS: Seepage water may be present; rooting usually shallow.

DISTRIBUTION: rare

Ledum groenlandicum

BLSB - LABRADOR TEA (ESSFav3/03)

INTERPRETATIONS

Logging:	- clearcut - attempt to reduce slash accumulations when logging to help meet site preparation objectives - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature; enhance natural regeneration; protect thin humus forms
Mechanical	- drag scarify; patch scarify; piling
Prescribed fire	- windrow and burn
Species choice:	
Preferred	- Pl
Acceptable	- Sx
Brush hazard:	- low to moderate (white-flowered rhododendron, fireweed)
Reforestation:	- conduct a Pl cone survey. If cones are insufficient and competition low, plant Pl stock without site preparation. - Pl may suffer snow press damage in areas of high snow accumulation
Concerns:	- windthrow - heavy snowpack - frost - large silviculture expenditures on these sites may be difficult to justify because of their low productivity, and management must ensure that productivity is not further reduced

ESSFmv3/04

BI - OAK FERN - KNIGHT'S PLUME

VEGETATION

R. albiflorum

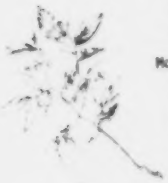
Tree Layer: 35% cover
Subalpine fir, Engelmann spruce

Shrub Layer: 45% cover

Rhododendron albiflorum	(white flowered rhododendron)
Vaccinium membranaceum	(black huckleberry)
Ribes lacustre	(black gooseberry)
Vaccinium ovalifolium	(oval-leaved blueberry)
[Lonicera involucrata	(black twinberry)]
subalpine fir	

Herb Layer: 45% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Orthilia secunda	(one-sided wintergreen)
Streptopus amplexifolius	(clasping twisted stalk)
Lycopodium annotinum	(stiff clubmoss)
Cornus canadensis	(bunchberry)
Valeriana sitchensis	(Sitka valerian)
Tiarella trifoliata	(three-leaved foamflower)
Veratrum viride	(Indian hellebore)



Moss Layer: 95% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
Barbilophozia lycopodioides	(common leafy liverwort)
Peltigera aphthosa	

SOIL AND SITE

Vaccinium membranaceum

Gymnocarpium dryopteris

Moisture Regime:	mesic - subhygric
Nutrient Regime:	medium - rich
• Slope Gradient (%):	18 (0-38)
• Slope Position:	usually mid to lower
Parent Material:	variable (often morainal)
Soil Texture:	variable
Coarse Fragments (%):	23 (5-48)
Site Index:	Se 26 (19-30)
	Pl 30 (on limited data)
	Bl 22 (16-33)

DISTRIBUTION: fairly common

BL - OAK FERN - KNIGHT'S PLUME (ESSFmv3/04)

INTERPRETATIONS

Logging:
- clearcut(winter); log on firm, deep snowpak if considering use of advanced regeneration

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; piling
- low ground pressure vehicles should be considered if mechanical site preparation is conducted on medium- to fine-textured soils

Prescribed fire
- broadcast burn* (remove L horizon) or windrow and burn
- short burning windows will likely necessitate burning in the summer

Species choice:

Preferred - Se
Acceptable - Bl

Brush hazard:
- very high (white flowered rhododendron, black twinberry, fireweed)
- post-planting inspections of harvested sites for should be carried out to determine the need vegetation control

Reforestation:
- use of advanced Se and Bl regeneration less than 1 m tall should be considered if it is abundant and well distributed. Advanced regeneration greater than 1 m tall will be difficult to protect and should be removed during logging
- plant large stock in summer kets
- avoid planting in depressions and frost po

Concerns:
- windthrow
- heavy snowpack
- frost
- snowmold

ESSFmv3/05

Bl - DEVIL'S CLUB - RHODODENDRON

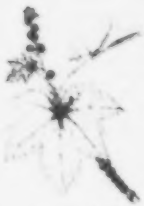
VEGETATION

R. albiflorum

Tree Layer: 40% cover
Engelmann spruce, subalpine fir

Shrub Layer: 30% cover

Rhododendron albiflorum	(white-flowered rhododendron)
Oplopanax horridus	(devil's club)
Ribes lacustre	(black gooseberry)
Vaccinium membranaceum	(black huckleberry)
Viburnum edule	(highbush-cranberry)
Alnus viridis ssp. sinuata	(Sitka alder)
Sorbus scopulina	(western mountain-ash)
subalpine fir	



Oplopanax horridus

Herb Layer: 50% cover

Gymnocarpium dryopteris	(oak fern)
Rubus pedatus	(five-leaved bramble)
Cornus canadensis	(bunchberry)
Tiarella trifoliata	(three-leaved foamflower)
Lycopodium annotinum	(stiff clubmoss)
Streptopus amplexifolius	(clasping twistedstalk)
Orthilia secunda	(one-sided wintergreen)

Moss Layer: 65% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Hylocomium splendens	(step moss)
[Mnium ssp.	(leafy mosses)]

SOIL AND SITE

Moisture Regime:	(mesic-) subhygric
Nutrient Regime:	(medium-) rich
• Slope Gradient (%):	13 (0-25)
• Slope Position:	(mid-) lower - level
Parent Material:	morainal or glaciofluvial
• Soil Texture:	variable (usually moderately fine)
Coarse Fragments (%):	25 (16-39)
• Seepage Water:	often present
Site Index:	Se 26 (24-29)
	Pl 25 (on limited data)
	Bl 26 (23-29)

Gymnocarpium dryopteris

DISTRIBUTION: uncommon

BL - DEVIL'S CLUB - RHODODENDRON (ESSFmv3/05)

INTERPRETATIONS

Logging:

- clearcut(winter); log on firm deep snowpack if considering use of advanced regeneration

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; piling
- low ground pressure vehicles should be considered if mechanical site preparation is conducted

Prescribed fire
- broadcast burn* (remove L horizon) or windrow and burn
- short burning windows will likely necessitate burning in the summer

Species choice:

Preferred
- Se

Acceptable
- Bl

Brush hazard:

- very high (white-flowered rhododendron, fireweed, highbush-cranberry, Sitka alder)
- post-planting inspections of harvested sites should be carried out to determine the need for vegetation control

Reforestation:

- use of advanced Se and Bl regeneration less than 1 m tall should be considered if it is abundant and well distributed. Advanced regeneration greater than 1 m tall will be difficult to protect and should be removed during logging.
- plant large stock in summer
- natural raised microsites provide the best planting spots on these sites; avoid planting in depressions and frost pockets

Concerns:

- windthrow
- heavy snowpack
- frost
- snowmold

ESSFmv3/06

Sxw - HUCKLEBERRY - HIGHBUSH-CRANE

VEGETATION

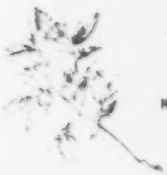
Tree Layer: 20% cover
Engelmann spruce, subalpine fir

Shrub Layer: 30% cover
Ribes lacustre
Lonicera involucrata
Viburnum edule
Vaccinium membranaceum
Alnus viridis ssp. sinuata
Rosa acicularis
Sorbus scopulina
subalpine fir

Herb Layer: 15% cover
Linnaea borealis
Cornus canadensis
Rubus pubescens
Mertensia paniculata
Lycopodium annotinum
Petasites palmatus
Arnica cordifolia
Orthilia secunda
Delphinium glaucum
Listera cordata

Moss Layer: 95% cover
Pleurozium schreberi
Ptilium crista-castrensis
Hylocomium splendens
Peltigera aphthosa
Barbilophozia lycopodioides

Ribes lacustre

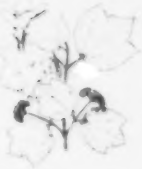


Vaccinium membranaceum

SOIL AND SITE

Moisture Regime:
Nutrient Regime:
Slope Gradient (%):
* Slope Position:
* Parent Material:
Coarse Fragments (%):
Site Index:

DISTRIBUTION: uncommon



Viburnum edule

SXW - HUCKLEBERRY - HIGHBUSH-CRANBERRY (ESSFmv3/06)

INTERPRETATIONS

Logging:
- clearcut or selective log
- if age distribution allows, selective log the stand protecting the advance Se regeneration with the aid of a good snowpack
- use a designated skidroad layout

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature

Mechanical
- patch scarify; piling
- low ground pressure vehicles should be considered if mechanical site preparation is conducted

Prescribed fire
- broadcast burn or windrow and burn
- short burning windows will likely necessitate burning in the summer

Species choice:

Preferred - Se
Acceptable - Bl

Brush hazard:
- very high (black twinberry, Sitka alder, fireweed)
- post-planting inspections of harvested sites should be carried out to determine the need for vegetation control

Reforestation:
- plant in summer
- natural raised microsites provide the best planting spots on these sites; avoid planting in depressions and frost pockets

Concerns:
- windthrow
- root rot
- herbicide use to control brush competition may conflict with wildlife needs

ESSFmv3/07

BI - HORSETAIL - FEATHERMOSS

Ribes lacustre

Equisetum arvense

Rubus pubescens

VEGETATION

Tree Layer: 20% cover
Engelmann spruce, lodgepole pine

Shrub Layer: 35% cover

Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Lonicera involucrata	(black twinberry)
Rosa acicularis	(prickly rose)
Alnus viridis ssp. sinuata	(Sitka alder)
subalpine fir	

Herb Layer: 80% cover

Equisetum spp. (arvense, sylvaticum)	(horsetails)
Galium spp. (boreale, triflorum	(bedstraws)
Rubus pubescens	(trailing raspberry)
Cornus canadensis	(bunchberry)
Mertensia paniculata	(tall bluebells)
Linnaea borealis	(twinflower)
Petasites palmatus	(palmate colt's-foot)
Epilobium anagallidifolium	(alpine willowherb)
Mitella nuda	(common mitrewort)

Moss Layer: 70% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
[Hylocomium splendens	(step moss)]

SOIL AND SITE

	Moisture Regime:	subhygric - hygric
	Nutrient Regime:	medium
*	Slope Gradient (%):	4 (2-6)
*	Slope Position:	level or depression
	Parent Material:	variable
	Soil Texture:	usually coarse
	Coarse Fragments (%):	30 (3-45)
*	Seepage Water:	generally present
	Site Index:	Se 24 (on limited data) Pl 28 (on limited data)

COMMENTS: Water table at or near surface.

DISTRIBUTION: uncommon

BL - HORSETAIL - FEATHERMOSS (ESSFmv3/07)

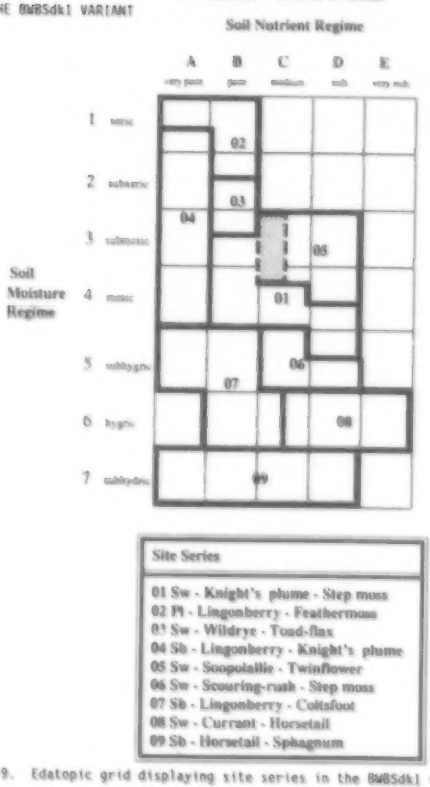
INTERPRETATIONS

Logging:	- clearcut - trafficability will be a problem on this site during the summer
Site preparation:	
Objective	- reduce debris; prepare raised planting spots; minimize future brush competition; improve planter access; increase soil temperature
Mechanical	- mound
Prescribed fire	- broadcast burn
Species choice:	
Preferred Acceptable	- Sx
Brush hazard:	- very high (black twinberry, Sitka alder, willows) - post-planting inspections of harvested sites should be carried out to determine the need for vegetation control
Reforestation:	- plant after water table drops below ground level and plant on drier microsites - use large vigorous planting stock
Concerns:	- windthrow - root rot - compaction - this association is critical to the control of runoff and stream flow - water table will likely rise above the ground surface in the spring causing seedling mortality - herbicide use to control brush competition may conflict with fish and wildlife needs

NOTES

8 THE BWBSdk1 VARIANT

BWBSdk1 Sikaine BWBSdk



Site Series
01 Sw - Knight's plume - Step moss
02 Pl - Lingonberry - Feathermoss
03 Sw - Wildrye - Toad-flax
04 Sb - Lingonberry - Knight's plume
05 Sw - Soopolallie - Twinflower
06 Sw - Scouring-rush - Step moss
07 Sb - Lingonberry - Coltsfoot
08 Sw - Currant - Horsetail
09 Sb - Horsetail - Sphagnum

FIGURE 9. Edatopic grid displaying site series in the BWBSdk1 variant.

KEY TO SITE UNITS OF THE BWBSdk1

1a Canopy dominated by black spruce; lower slope to toe or depression

2a Usually organic soils; moss layer dominated by Sphagnum spp. (p. 63)[13]

BWBSdk1/08

2b Usually mineral soils; moss layer dominated by feather mosses

BWBSdk1/06

1b Black spruce, if present in canopy, with lodgepole pine; slope position variable

3a Canopy dominated by white spruce

4a Lower slope to toe, or level; Ledum groenlandicum (p. 9) or Equisetum spp. (p. 24) moderate to high cover (>5%)

5a Level; soils fluvial; black spruce absent from canopy; Ledum groenlandicum absent, Alnus incana (p. 7) present

BWBSdk1/07

5b Lower slope to toe; soils variable but usually not fluvial; black spruce present in canopy; Ledum groenlandicum present, Alnus incana absent

BWBSdk1/04

4b Slope position variable; Ledum groenlandicum and Equisetum spp. low cover (<1%) or absent

6a Mid to lower slope; fine- to medium-textured soils; poorly developed shrub and herb layers

BWBSdk1/05

6b Slope position variable but often mid; medium- to coarse-textured soils; fairly well-developed shrub and herb layer

BWBSdk1/01

3b Canopy dominated by lodgepole pine or lodgepole pine - black spruce

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13 Page numbers refer to the publication "Some Common Plants of the Sub-boreal Spruce Zone" (Pojar et al. 1982).

7a Black spruce moderate to high cover (>5%) in tree or shrub layer; Ledum groenlandicum present and often abundant (>5% cover)

8a Mid-slope to crest or level; seepage water usually absent

BwSSdk1/04

8b Lower slope to toe; seepage water usually present

BWBSdk1/06

7b Black spruce low cover (<5%) or absent in tree or shrub layer; Ledum groenlandicum low cover (<1%) or absent

9a Coarse-textured fluvial soils or shallow soils over bedrock; Viburnum edule (p. 15) absent, Cladina spp. (p. 55) moderate to high cover (>5%)

BWBSdk1/02

9b Soils variable but never shallow over bedrock; Viburnum edule usually present, Cladina spp. low cover (<1%) or absent

10a Mid-slope to crest; soils often coarse; Elymus innovatus (fuzzy-spiked wild rye) often abundant (>5%)

BWBSdk1/03

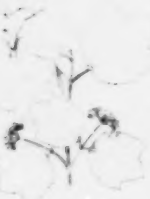
10b Slope position variable but often mid; soils variable; Elymus innovatus usually low cover (<5%) or absent

BWBSdk1/01

BWBSdk1/01

Sw - KNIGHT'S PLUME - STEP MOSS

VEGETATION



Viburnum edule

Tree Layer: 60% cover
White spruce, lodgepole pine

Shrub Layer: 50% cover

Viburnum edule	(highbush-cranberry)
Rosa acicularis	(prickly rose)
Shepherdia canadensis	(soopolallie)
white spruce	
subalpine fir	

Herb Layer: 25% cover

Orthilia secunda	(one-sided wintergreen)
Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Epilobium angustifolium	(fireweed)
Petasites palmatus	(palmate coltsfoot)
Mertensia paniculata	(tall bluebells)
Pyrola asarifolia	(rosy wintergreen)

Orthilia secunda

Moss Layer: 90% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Peltigera spp.	

SOIL AND SITE

Moisture Regime:	submesic - subhygric
Nutrient Regime:	poor - medium (-rich)
Slope Gradient (%):	0-85, usually less than 30
Slope Position:	upper - lower or level
Parent Material:	variable but usually morainal or glaciofluvial
* Soil Texture:	medium-coarse
Coarse Fragments (%):	0-75
Site Index:	Pl 24 (16-33) Sw 25 (13-34)

DISTRIBUTION: very common

Hylocomium splendens

Sw - KNIGHT'S PLUME - STEP MOSS (BWBSdk1/01)

INTERPRETATIONS

Logging:	- clearcut - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals - harvest fine-textured moraines during the dry part of summer or in winter - trafficability may be a problem if long durations of heavy rainfall occurs
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature; enhance natural regeneration
Mechanical	- drag scarify*; disc trench; C & H plow; piling; mix humus with mineral
Prescribed fire	- light broadcast burn on south aspect; higher intensity burn on north aspect
Species choice:	
Preferred Acceptable	- Sw, Pl
Brush hazard:	- moderate (fireweed, highbush-cranberry, prickly rose)
Reforestation:	- conduct a Pl cone survey to determine if enough seed is present to establish a natural Pl stand. If so, drag scarify the site. - plant Pl on south aspect, plant Sw on north aspect - plant as soon as the frost is out of the ground
Concerns:	- aspect is one of the most important factors affecting site productivity on this ecosystem. Managers should tailor their prescriptions accordingly.

BWBSdk1/02

Pl - LINGONBERRY - FEATHERMOSS

lodgepole pine

S. canadensis

Vaccinium vitis-idaea

VEGETATION

Tree Layer: 20% cover
Lodgepole pine, white spruce

Shrub Layer: 20% cover

Shepherdia canadensis	(soapolallie)
lodgepole pine	
white spruce	
subalpine fir	

Herb Layer: 10% cover

Linnaea borealis	(twinflower)
Vaccinium vitis-idaea	(lingonberry)
Arctostaphylos uva-ursi	(kinnikinnick)
Vaccinium caespitosum	(dwarf blueberry)
Cornus canadensis	(bunchberry)

Moss Layer: 70% cover

Cladina spp.	
Pleurozium schreberi	(red-stemmed feathermoss)
Cladonia spp.	
Peltigera aphthosa	
Stereocaulon tomentosum	
Polytrichum juniperinum	(juniper haircap moss)

SOIL AND SITE

Moisture Regime:	xeric - subxeric
Nutrient Regime:	very poor - poor
Slope Gradient (%):	0-30
Slope Position:	variable
* Parent Material:	glaciofluvial or colluvium over rock
* Soil Texture:	coarse - medium
Coarse Fragments (%):	30-80
Site Index:	Pl 19 11-26

COMMENTS
Moss layer can be dominated by feathermoss or lichens.

DISTRIBUTION: uncommon

PL - LINGONBERRY - FEATHERMOSS (BWBSdk1/02)

INTERPRETATIONS

Logging:
- clearcut
- full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals

Site preparation:

Objective
- enhance natural regeneration; reduce debris; prepare planting spots; improve moisture status; improve planter access

Mechanical
- drag scarify*; disc trench

Prescribed fire
- do not burn

Species choice:

Preferred
Acceptable
- Pl

Brush hazard:
- low

Reforestation:
- conduct a Pl cone survey to see if enough seed is present to have a natural Pl stand established. If cone survey results indicate little seed then plant Pl, but expect heavy mortality due to droughty conditions.

Concerns:
- severe drought period
- mistletoe
- expect stocking levels to take 10 years to achieve
- because these sites are marginal for timber production, silvicultural investment may be difficult to justify, and management must ensure that productivity is not further reduced

BWBSdk1/03

Sw - WILDRYE - TOAD-FLAX

Rosa acicularis

VEGETATION

Tree Layer: 35% cover
Lodgepole pine, white spruce

Shrub Layer: 30% cover

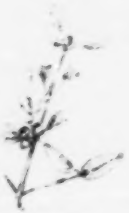
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
Shepherdia canadensis	(soopolallie)
white spruce	

Herb Layer: 20% cover

Linnaea borealis	(twinflower)
Cornus canadensis	(bunchberry)
Orthilia secunda	(one-sided wintergreen)
Epilobium angustifolium	(fireweed)
Elymus innovatus	(fuzzy-spiked wildrye)
Mertensia paniculata	(tall bluebells)

Moss Layer: 80% cover

Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Ptilium crista-castrensis	(knight's plume)
Peltigera aphthosa	



S. canadensis

SOIL AND SITE

	Moisture Regime:	submesic - mesic
	Nutrient Regime:	poor - (medium)
*	Slope Gradient (%):	5-90 usually less than 30
*	Slope Position:	mid to crest or level
	Parent Material:	glaciofluvial or morainal
*	Soil Texture:	coarse to medium
	Coarse Fragments (%):	0-75
	Site Index:	Pl 23 (18-31) Sw 21 (12-28)

DISTRIBUTION: common

Elymus innovatus

SW - WILDRYE - TOAD-FLAX (BWBSdk1/03)

INTERPRETATIONS

Logging:	- clearcut - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
Site preparation:	
Objective	- enhance natural regeneration; reduce debris; prepare planting spots; improve moisture status; improve planter access
Mechanical	- drag scarify*; disc trench
Prescribed fire	- light broadcast burn on deeper humus
Species choice:	
Preferred Acceptable	- Pl
Brush hazard:	- low - grass competition is possible
Reforestation:	- conduct a Pl cone survey to see if enough seed is present to have a natural Pl stand established and to see if drag scarification is required. If cone survey results indicate little seed, then plant Pl, but expect mortality due to droughty conditions.
Concerns:	- drought - mistletoe

BWBSdk1/04

Sb - LINGONBERRY - KNIGHT'S PLUME

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, white spruce, black spruce

Shrub Layer: 35% cover

Ledum groenlandicum	(Labrador tea)
Shepherdia canadensis	(soopolallie)
black spruce	

black spruce

Herb Layer: 15% cover

Vaccinium vitis-idaea	(lingonberry)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Empetrum nigrum	(crowberry)
Elymus innovatus	(fuzzy-spiked wildrye)

Moss Layer: 90% cover

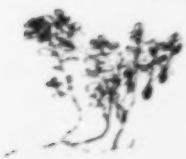
Pleurozium schreberi	(red-stemmed feathermoss)
Hylocomium splendens	(step moss)
Peltigera aphthosa	
Ptilium crista-castrensis	(knight's plume)
Cladina spp.	

Ledum groenlandicum

SOIL AND SITE

Moisture Regime:	subxeric - submesic (-mesic)
Nutrient Regime:	(very poor) - poor
Slope Gradient (%):	0-45
* Aspect:	usually north if sloping
* Slope Position:	mid to crest or level
Parent Material:	glaciofluvial or morainal
Soil Texture:	medium to coarse
Coarse Fragments (%):	0-80
Site Index:	Pl 20 (16-23)
	Sw 21 (18-25)

DISTRIBUTION: uncommon



Vaccinium vitis-idaea

SB - LINGONBERRY - KNIGHT'S PLUME (BWBSdk1/04)

INTERPRETATIONS

Logging:	- clearcut - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals
Site preparation:	
Objective	- enhance natural regeneration; reduce debris; prepare planting spots; improve moisture status; improve planter access
Mechanical	- drag scarify*
Prescribed fire	- do not burn
Species choice:	
Preferred Acceptable	- Pl
Brush hazard:	- low
Reforestation:	- conduct a Pl cone survey to see if enough seed is present to have a natural Pl stand established. If cone survey results indicate little seed, then plant Pl, but expect heavy mortality due to droughty conditions.
Concerns:	- drought - mistletoe - expect stocking levels to take 10 years to achieve - because these sites are marginal for timber production, silvicultural investment may be difficult to justify, and management must ensure that productivity is not further reduced

BWBSdk1/05

Sw - SOOPOLALLIE - TWINFLOWER

VEGETATION

Tree Layer: 60% cover
Lodgepole pine

Shrub Layer: 45% cover

Shepherdia canadensis	(soopolallie)
Rosa acicularis	(prickly rose)
Viburnum edule	(highbush-cranberry)
lodgepole pine	

lodgepole pine

Herb Layer: 70% cover

Linnaea borealis	(twinflower)
Arctostaphylos uva-ursi	(kinnikinnick)
Geocaulon lividum	(bastard toad-flax)
Arnica cordifolia	(heart-leaved arnica)
Cornus canadensis	(bunchberry)

Moss Layer: 20% cover

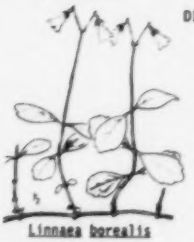
Polytrichum spp.	
Pleurozium schreberi	(red-stemmed feathermoss)

S. canadensis

SOIL AND SITE

Moisture Regime:	submesic (- mesic)
Nutrient Regime:	medium-rich
Slope Gradient (%):	0-5
* Aspect:	N/A
* Slope Position:	level
Parent Material:	(glacio-) fluvial
Soil Texture:	medium - moderately coarse
Coarse Fragments (%):	variable

DISTRIBUTION: uncommon



Linnaea borealis

SW - SOOPOLALLIE - TWINFLOWER (BWBSdk1/05)

INTERPRETATIONS

Logging:	- clearcut - full tree harvesting may seriously reduce cones on a site; good cone distribution must be ensured if managing for naturals - harvest fine-textured moraines during the dry part of summer or in winter - trafficability may be a problem if long durations of heavy rainfall occurs
Site preparation:	
Objective	- reduce debris; prepare planting spots; improve planter access; increase soil temperature; enhance natural regeneration
Mechanical	- drag scarify*; piling; mix humus with mineral
Prescribed fire	- light broadcast burn
Species choice:	
Preferred Acceptable	- Pl, (Sw)
Brush hazard:	- low (fireweed, highbush-cranberry, prickly rose)
Reforestation:	- conduct a Pl cone survey to determine if enough seed is present to establish a natural Pl stand. If so, drag scarify the site. - plant as soon as the frost is out of the ground
Concerns:	

BWBSdk1/06

Sw - SCOURING-RUSH - STEP MOSS

VEGETATION

Tree Layer: 40% cover
White spruce

Shrub Layer: 10% cover
white spruce

Herb Layer: 7% cover

Linnaea borealis	(twinflower)
Arctostaphylos rubra	(red bearberry)
Equisetum scirpoides	(dwarf scouring-rush)
Festuca altaica	(Altai fescue)
Empetrum nigrum	(crowberry)
[Vaccinium vitis-idaea	(lingonberry)]

Arctostaphylos rubra

Moss Layer: 90% cover

Hylocomium splendens	(step moss)
Peltigera spp.	
Pleurozium schreberi	(red-stemmed feathermoss)
Dicranum spp.	

SOIL AND SITE

	Moisture Regime:	subhygric
	Nutrient Regime:	medium - rich
	Slope Gradient (%):	5-15
*	Slope Position:	lower to mid
	Parent Material:	variable
*	Soil Texture:	fine to medium
	Coarse Fragments (%):	0-75
	Site Index:	Sw 26 (21-32) Pl 26 (21-33)

Equisetum scirpoides

DISTRIBUTION: uncommon

Hylocomium splendens

SW - SCOURING-RUSH - STEP MOSS (BWBSdk1/06)

INTERPRETATIONS

Logging:
- clearcut

Site preparation:

Objective
- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature; enhance natural regeneration

Mechanical
- patch scarify; mix humus with mineral soil

Prescribed fire
- light broadcast burn*; pile and burn

Species choice:

Preferred
Acceptable
- Pl, Sw

Brush hazard:
- moderate (trembling aspen, fireweed)
- brush competition will likely occur within 3 years of harvesting; sites should be inspected at 3 years to determine if any further treatment is required
- pre-harvesting hack-and-squirt should be done at least 2 years prior to harvest
- aspen suckering can be a problem on these sites

Reforestation:
- vigorous stock should be planted immediately after site preparation

Concerns:
- aspen competition

BWBSdk1/07

Sb - LINGONBERRY - COLTSFOOT

VEGETATION

Tree Layer: 30% cover
Lodgepole pine, white spruce, black spruce

black spruce

Shrub Layer: 30% cover

Ledum groenlandicum	(Labrador tea)
Rosa acicularis	(prickly rose)
Salix spp.	(willows)
black spruce	

Herb Layer: 15% cover

Vaccinium vitis-idaea	(lingonberry)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Mertensia paniculata	(tall bluebells)
Equisetum scirpoides	(dwarf scouring-rush)
Orthilia secunda	(one-sided wintergreen)
Petasites palmatus	(palmate coltsfoot)
Pyrola asarifolia	(rosy wintergreen)

Moss Layer: 95% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Cladina spp.	
Peltigera aphthosa	

Ledum groenlandicum *

SOIL AND SITE

Moisture Regime:	subhygric - hygric
Nutrient Regime:	poor - medium
Slope Gradient (%):	0-45
Slope Position:	lower - toe, occasionally mid
Parent Material:	morainal, fluvial or organic
Soil Texture:	medium to coarse
Coarse Fragments (%):	0-80
Site Index:	Pl 23 (22-24) Sw 20 (17-23)

DISTRIBUTION: uncommon

Vaccinium vitis-idaea

SB - LINGONBERRY - COLTSFOOT (BWBSdk1/07)

INTERPRETATIONS

Logging:	- clearcut - trafficability will be a problem on these sites during the summer
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature; prepare raised planting sites
Mechanical	- plow; mound*
Prescribed fire	- broadcast burn
Species choice:	
Preferred	- Sw
Acceptable	- Pl
Brush hazard:	- high (willows, prickly rose, fireweed) - post-planting inspections of harvested sites should be carried out to determine the need for vegetation control
Reforestation:	- plant after water table drops below ground level and plant on drier microsites - use large planting stock
Concerns:	- root rot (if managing for Sw) - compaction - windthrow hazard is extreme - this association is critical to the control of runoff and stream flow - water table on level sites will likely rise above the ground surface in the spring causing seedling mortality - herbicide use to control brush competition may conflict with wildlife needs

BWBSdk1/08

Sw - CURRANT - HORSETAIL

VEGETATION

Tree Layer: 40% cover
White spruce

Shrub Layer: 25% cover

Alnus incana ssp. tenuifolia	(mountain alder)
Rosa acicularis	(prickly rose)
Ribes lacustre	(black gooseberry)
Viburnum edule	(highbush-cranberry)
Ribes triste	(red swamp currant)
white spruce	

Alnus incana ssp. tenuifolia

Herb Layer: 60% cover

Equisetum spp. (pratense, arvense)	(horsetails)
Cornus canadensis	(bunchberry)
Linnaea borealis	(twinflower)
Mertensia paniculata	(tall bluebells)
Mitella nuda	(common mitrewort)
Rubus pubescens	(trailing raspberry)
Orthilia secunda	(one-sided wintergreen)

Moss Layer: 95% cover

Hylocomium splendens	(step moss)
Pleurozium schreberi	(red-stemmed feathermoss)
Ptilium crista-castrensis	(knight's plume)
Minium spp.	(leafy mosses)

Ribes triste

SOIL AND SITE

Moisture Regime:	subhygric - hygric
Nutrient Regime:	rich
* Slope Gradient (%):	0-3
* Slope Position:	level or toe
* Parent Material:	fluvial or organic
Soil Texture:	medium to coarse
Coarse Fragments (%):	0
Site Index:	Sw 28 (26-31)

DISTRIBUTION: rare

Equisetum pratense

SW - CURRANT - HORSETAIL (BWBSdk1/08)

INTERPRETATIONS

Logging:	- clearcut - trafficability will be a problem on these sites during the summer
Site preparation:	
Objective	- reduce debris; prepare planting spots; minimize future brush competition; improve planter access; increase soil temperature; prepare raised planting sites
Mechanical	- plow; mound*
Prescribed fire	- broadcast burn
Species choice:	
Preferred Acceptable	- Sw
Brush hazard:	- very high (mountain alder, prickly rose, fireweed) - post-planting inspections of harvested sites should be carried out to determine the need for vegetation control
Reforestation:	- plant as soon as frost is out of the ground - use large planting stock
Concerns:	- herbicide use to control brush competition may conflict with wildlife needs - windthrow - root rot - compaction - this association is critical to the control of runoff and stream flow - water table will likely rise above the ground surface in the spring causing seedling mortality

BWBSdk1/09

Sb - HORSETAIL - SPHAGNUM

VEGETATION

Tree Layer: 15% cover
Black spruce

Shrub Layer: 70% cover

Ledum groenlandicum	(Labrador tea)
Salix spp.	(willows)
black spruce	

Herb Layer: 70% cover

Equisetum spp. (arvense, scirpoides)	(horsetails)
Carex spp.	(sedges)
Vaccinium ssp. (vitis-idaea, oxycoccus)	(lingonberry, bog cranberry)

Moss Layer: 90% cover

Sphagnum spp.	(sphagnum mosses)
Hylocomium splendens	(step moss)
Aulacomnium palustre	(glow moss)

Ledum groenlandicum

Equisetum arvense

SOIL AND SITE

Moisture Regime:	hygric - subhydric
Nutrient Regime:	poor - medium
• Slope Gradient (%):	0-12 (usually less than 5)
• Slope Position:	level, toe or depression
• Parent Material:	organic
Soil Texture:	fibric or humic
Coarse Fragments (%):	0
Site Index:	Sb 15

DISTRIBUTION: common

Sphagnum spp.

SB - HORSETAIL - SPHAGNUM (BmBSdk1/9)

INTERPRETATIONS

Management objectives: - non-commercial at this time

10 LITERATURE CITED

Coates, D. and S. Haeussler. 1987. A guide to the use of mechanical site preparation equipment in north central British Columbia. 2nd ed. North. Silv. Committee and Canada/B.C. Economic and Regional Development Agreement, Victoria, B.C. FRDA Handb. No. 2. 64 p.

Coupé, R., C.A. Ray, A. Comeau, M.V. Ketcheson, and R.M. Annas. 1982. A guide to common plants of the Skeena area, British Columbia. B.C. Min. For., Victoria, B.C. Land Manage. Handb. No. 4. 215 p.

Fenger, M., T. Lea and B. Fuhr. 1989. Regional wildlife habitat maps. Omineca North, Omineca South. B.C. Min. Environ., Wildl. Branch, Victoria, B.C.

Goward, T. 1987. Unpublished illustrations. Property of the Royal B.C. Museum, Victoria, B.C.

Green, R.N., Courtin, P.J., Klinka, K., Slaco, R.J., and Ray, C.A. 1984. Site diagnosis, tree species selection and slashburning guidelines for the Vancouver Forest Region. B.C. Min. For., Victoria, B.C. Land Manage. Handb. No. 8. 143 p.

Hale, M. 1979. How to know the lichens. 2nd ed. Wm. C. Brown Company Publishers, Dubuque, Iowa. 246 p.

Hitchcock, C., A. Cronquist, M. Ownbey, and J. Thompson. 1977. Vascular plants of the Pacific Northwest. Parts 1-5. Univ. Wash. Press, Seattle, Wash.

Holland, S.S. 1976. Landforms of British Columbia. A physiographic outline. 2nd ed. B.C. Dep. Mines and Mineral Resources, Victoria, B.C. Bull. No. 48. 138 p.

Luckhurst, A.J. 1973. Stone sheep and their habitat in the northern Rocky Mountain Foothills of British Columbia. M.Sc. thesis. Univ. B.C., Dep. Plant Sci., Vancouver, B.C. 147 p.

Meidinger, D. 1987. Recommended vernacular names for common plants of British Columbia. B.C. Min. For., Victoria, B.C. Res. Rep. RR87002-HQ. 64 p.

Pojar, J. 1983. Spruce - Willow - Birch Zone. In Forestry Handbook for British Columbia. 4th ed. Univ. B.C., Forestry Undergraduate Society, Vancouver, B.C., pp. 301-306.

_____. 1986. Vegetation and ungulate habitat in the Gladys Lake Ecological Reserve, northern British Columbia. B.C. Min. For., Smithers, B.C. Res. Rep. RR85009-PR. 99 p.

Pojar, J., R. Love, D. Meidinger, and R. Scagel. 1982. Some common plants of the Sub-Boreal Spruce Zone. B.C. Min. For., Victoria, B.C. Land Manage. Handb. No. 6. 102 p.

Schofield, W. 1968. Some Mosses of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 28. 262 p.

Szczawinski, A. 1959. The Orchids of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 16. 124 p.

_____. 1962. The Heather family (Ericaceae) of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 19. 205 p.

Taylor, T. 1966. The Lily family (Liliaceae) of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 25. 109 p.

_____. 1973a. The Ferns and Fern-Allies of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 12. 172 p.

_____. 1973b. The Rose family (Rosaceae) of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 30. 223 p.

_____. 1974a. The Figwort family (Scrophulariaceae) of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 33. 237 p.

_____. 1974b. The Pea family (Leguminosae) of British Columbia. Royal B.C. Museum, Victoria, B.C. Handb. No. 32. 251 p.

Taylor, R. and B. MacBryde. 1977. Vascular plants of British Columbia. Univ. B.C. Press, Vancouver, B.C. Botanical Gardens Techn. Bull. No. 4. 754 p.

APPENDIX 1. Meso slope position diagram

a. Crest - the generally convex uppermost portion of a hill (meso scale). It is usually convex in all directions, no distinct aspect.

b. Upper Slope - the generally convex upper portion of the slope of a hill (meso scale) immediately below the crest. It has a convex surface profile with a specific aspect.

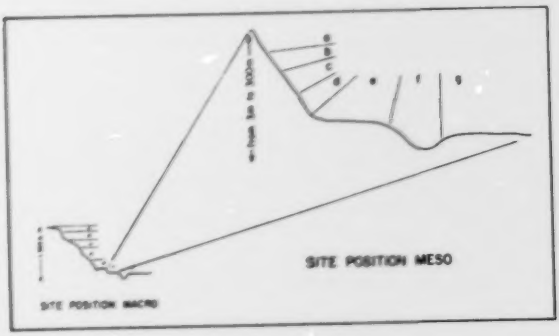
c. Middle Slope - the area of the slope of a hill between the upper slope and the lower slope, where the slope profile is not generally concave or convex, it has a straight or somewhat irregular surface profile with a specific aspect.

d. Lower Slope - the area toward the base of the slope of the hill. It generally has a concave surface profile with a specific aspect.

e. Toe - area defined by extent of homogeneous site of slight slope, clearly demarcated by an abrupt decrease in the slope below and adjacent to the lower slope.

f. Depression - any area that is concave in all directions, generally at the foot of a meso scale hill or in generally level area.

g. Level - any level meso scale area not adjacent to a meso scale unit. The surface profile is generally horizontal with no significant aspect.



APPENDIX 2. Hand texturing field guide

Soil texture refers to the relative proportions of the sand, silt, and clay separates within a soil. These separates have their own distinctive properties of "feel", allowing one to estimate their proportions in a sample of soil by hand texturing. Texture can be estimated very roughly from a dry sample. Clayey materials are very hard, loamy and silty materials are slightly hard to soft, and sandy materials are loose grained. To be more precise, hand texturing should be done using the wet sample procedure given below.

Step 1

Obtain a small handful of soil, crush it in the hand, and remove coarse fragments (particles greater than 2 mm in diameter).

Step 2

Gradually add water to the soil and work it into a moist putty with a soil knife or fingers. The correct moisture content is important. If the putty flows with the force of gravity, then it is too wet. If it crumbles when rolled, then it is too dry. It should have the consistency of a filler putty.

Step 3

Determine stickiness of the soil putty by working it between the thumb and forefinger, pressing and then separating the fingers. An estimate of clay content can be made in this way. (Clay limits below are approximate.)

NONSTICKY: practically no soil material adheres to the thumb and forefinger (less than 10% clay).

SLIGHTLY STICKY: soil material adheres only to one of the fingers and comes off the other rather cleanly. The soil does not stretch appreciably when fingers are separated (less than 25% clay).

STICKY: soil material adheres to both fingers and stretches slightly before breaking when fingers are pulled apart (25-40% clay).

VERY STICKY: soil putty adheres strongly to both fingers and stretches distinctly before breaking (greater than 40% clay).

Step 4

Determine the grittiness of the soil putty by rubbing it between thumb and forefinger. An estimate of sand content can be made in this way. (Sand limits below are approximate.)

NONGRITTY: Little or no grit can be felt (less than 20% sand).

SLIGHTLY GRITTY: Some grit is felt but non gritty material (silt and clay) is dominant (20-50% sand).

GRITTY: Sand is felt as the dominant material. Some non gritty material can be felt between sand grains (50-80% sand).

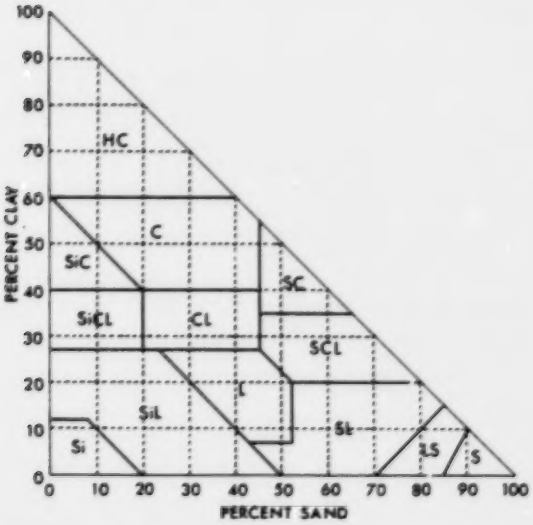
VERY GRITTY: Sand is the only material that is felt. Little or no non gritty material present (greater than 80% sand).

Step 5

After stickiness and grittiness have been determined, the hand texturing table can be used as an approximate guide to the textural class of the soil. The textural triangle (Figure 14) can be used for a more accurate determination of the textural class.

	NON GRITTY (<20% sand)[a]	SLIGHTLY GRITTY (20-50% sand)	GRITTY (50-80% sand)	VERY GRITTY (>80% sand)
VERY STICKY (>40% clay)[a]	SILTY CLAY	CLAY	SANDY CLAY	--
STICKY (25-40% clay)	SILTY CLAY LOAM	CLAY LOAM	SANDY CLAY LOAM	--
SLIGHTLY STICKY (10-25% clay)	SILT LOAM or SILT	LOAM[b]	SANDY LOAM	--
NON STICKY (<10% clay)	--	--	--	LOAMY SAND or SAND

a Sand and clay limits are approximate.
b A loam is a textural class exhibiting physical properties intermediate between those of sand, silt, and clay.



Soil textural triangle.

APPENDIX 3. Identification of upland humus forms

Mors:	- matted F horizon[a] - common fungal mycelium (white or yellow) - little or no intermixing of organic and mineral materials - abrupt boundary between organic and mineral horizons
Moders:	- loosely arranged F horizon[a] - friable - insect droppings - fungal mycelium and soil organisms (arthropods and occasional earthworms) - intermixing of organic and mineral horizons - gradual transition between mineral and organic horizons
Mulls:	- often no F[a] or H horizons (thin if present) - insect droppings abundant - usually many soil organisms but may form from decomposition of a dense network of roots (usually abundant earthworms) - considerable intermixing of mineral and organic layers, with incorporation of organic matter into surface mineral soil (Ah horizon)

[a]F horizon: horizon in which partial (rather than entire), macroscopically recognizable vegetative structures are dominant (i.e., the horizon is partially decomposed).

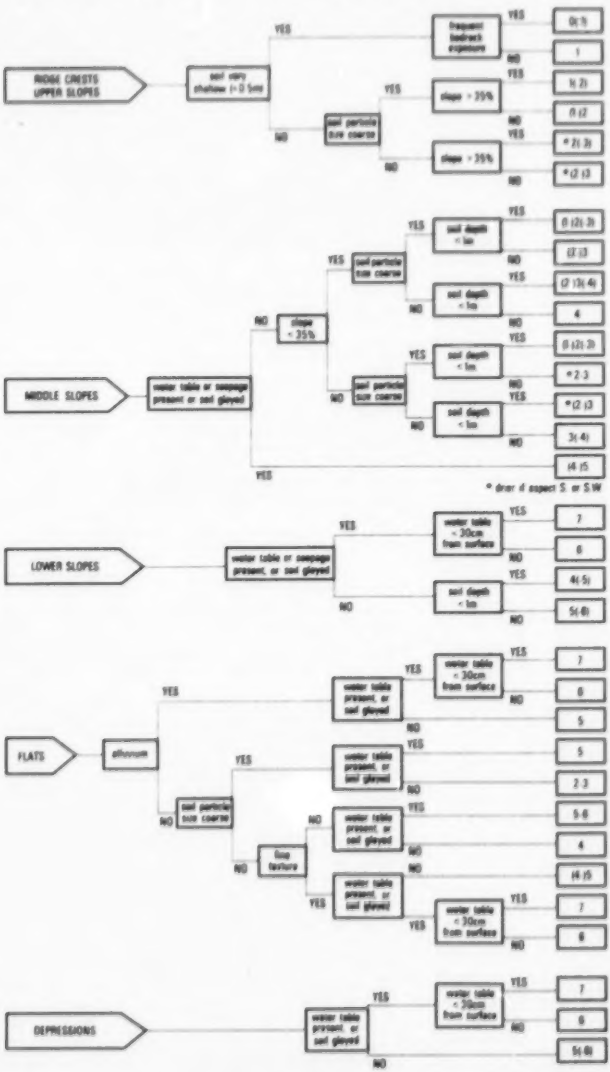
APPENDIX 4. Key to the identification of potential moisture regime (part 1) (from Green et al. 1984)

This key was devised to aid field staff in identifying potential moisture regimes using readily observable environmental features. It should be applied with caution on ridge crests, upper slopes, and middle slopes which have soils with thick (>20 cm) organic layers. Moisture regime in these cases will generally be higher than indicated. The table below provides definitions for the categories used in the key.

Category	Definition
Ridge crest	height of land; usually convex slope shape.
Upper slope*	the generally convex shaped, upper portion of a slope.
Middle slope	the portion of a slope between the upper and lower slopes; the slope shape is usually straight.
Lower slope	the area towards the base of a slope; the slope shape is usually concave. It includes toe slopes which are generally level areas located directly below and adjacent to the lower slope.
Flat	any level area (excluding toe slopes); the surface shape is generally horizontal with no significant aspect.
Alluvium	post-glacial, active floodplain deposits along rivers and streams in valley bottoms; usually a series of low benches and channels.
Depression	any area that is concave in all directions; usually at the foot of a slope or in flat topography.
Soil depth	depth from the mineral soil surface to a restricting layer such as bedrock, strongly compacted, or strongly cemented materials (e.g. "hardpan").
Gleyed	soils that have orange coloured mottles indicative of a fluctuating water table. Permanently gleyed soils are dull yellowish, blue, or olive in colour.
Soil particle size coarse	sandy* with > 35% volume of coarse fragments, or loamy* with > 70% volume of coarse fragments.
Fine texture	silty* or clayey* with a low coarse fragment volume.

* Sandy - LS, S. loamy - SL, L, SCL clayey - SCL, CL, SC, SiC, C. silty - SiL, Si.

APPENDIX 4. Key to the identification of potential moisture regime (part 2)



APPENDIX 5. Key to the identification of soil nutrient regime[A]

1a Coarse-textured

2a Very high coarse fragments (>50%) or very shallow (<30 cm) soil.

3a Mor humus form

Very Poor

3b Moder humus form

Poor - Medium

2b Low or zero coarse fragments, deep soil

4a Mor humus form

Poor

4b Moder humus form

Medium

4c Mull humus form

Rich - Very Rich

1b Moderately coarse- and medium-textured

5a Very high coarse fragments (>50%); or very shallow soil (<30 cm); or shallow rooting depth

6a Mor humus form

Poor

6b Moder

Medium

5b Low or zero coarse fragments without restricted rooting depth

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[A] The presence of base-rich parent materials (limestone, shales, basalt) may improve the nutrient status.

7a Mor humus form

Poor - Medium

7b Moder humus form

Medium - rich

7c Mull humus form

Very rich

1c Moderately fine- and fine-textured

8a Very high coarse fragments (rare); or very shallow soil; or shallow rooting depth (<15 cm)

9a Mor humus form

Poor - Very Poor

9b Moder humus form

Medium - Poor

9c Mull humus form

Rich

8b Low or zero coarse fragments, with good rooting depth (>20 cm)

10a Mor humus form

Medium

10b Moder humus form

Rich

10c Mull humus form

Very Rich